A.D. 1845 . . . . N° 10,659

SPECIFICATION

OF

JOSEPH AMESBURY.

APPARATUS FOR THE RELIEF OR CORRECTION OF STIFFNESS, WEAKNESS, OR DISTORTION IN THE HUMAN BODY.

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Apparatus for the Relief or Correction of Stiffness, Weakness, or Distortion in the Human Body.

AMESBURY'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Joseph Amesbury, of 12, Devonshire Street, Portland Place, in the Parish of Saint Mary-le-Bone, and County of Middlesex, Surgeon, send greeting.

WHEREAS Her present most Excellent Majesty Queen Victoria, by Her Royal Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Sixth day of May, in the eighth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Joseph Amesbury, Her especial licence, full power, sole privilege and authority, that I, the said Joseph Amesbury, my exors, adm̃ors, and assigns, or such others as I, the said Joseph Amesbury, my exors, adm̃ors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick-upon-Tweed, my Invention of "Improvements in Apparatus for the Relief or Correction of Stiffness, Weakness, or Distortion in the Human Body;" in which said Letters Patent is contained a proviso that I, the said Joseph Amesbury, shall cause a particular description of the nature of my Invention, and in what manner the same is to be performed, to be enrolled in Her said Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said in part recited

Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Joseph Amesbury, do hereby declare the nature of my Invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof, reference being had to the Drawings hereunto annexed, and to the figures and letters marked thereon, that is to say:—

The group of Figures, from one to thirty-eight inclusive, shew the apparatus which I have invented to be used in certain distortions and weaknesses as they occur in the lower extremities. Figure I., a compound bar of steel. Figure II., an edge view of the same. Figure III. shews the compound bar in the bent position, with an additional plate hereafter to be described. A, Figures I., III., and IV., a curved lever received into a notch, seen in Figure II. at *a*, and rivetted at *b*, Figures I., III., and IV., so as to allow it a limited movement in a direction perpendicular to the bar. This curved lever has a loop formed at each end *c*, *c*, Figures I., III., and IV. It is curved, Figure IV., to suit the side of the hips of the person and to prevent injury to the soft parts. In some cases only one limb of this bar is used, as seen at Figure III. The part B, Figures I., III., IV., has formed in it at *d* long loops rounded at the edges, and several screw holes *e*, Figures I. and III., and is turned so as to form a loop at the lower end *f*. Through this loop the part C passes, and it is fastened to the part B by a screw received into one of the screwed holes in the part B, as seen at *g*, Figures I., II., and III. The lower end of the piece C is strengthened by a piece of steel placed on one side of it *h*. This piece and the part C are wider at the lower ends and extended and cut so as to form the cheeks between which the upper end of the part D, Figure V., is received. These parts are rivetted together by a screwed rivet *i* so as to form a knuckle joint. In the part C is placed a pin or stud *k*, and this part is hollowed out at the side so as to receive the projecting part *l* of the catch, Figure VI., which is rivetted to the pieces *h* and part C at *m*. The part C and the strengthened part *h* together are so made as to allow the spring *n* in the catch, Figures I., III., VI., to move upon them. This spring is rivetted to the catch at *o*. A groove is formed in these parts so as to admit the part *p* of the catch, Figure VI., as seen in Figure I. The lower end *q* of the catch is enlarged, and made in the form of an irregular square, the projecting part of which *r* is received into a notch *s*, formed in the sides of the pieces C and *h* and in the side of the upper end of the part D, Figure V, as seen at *s*, Figure I. When the catch is forced into the notch by the action of the spring *n*, the parts C and D are immoveably fixed together; but when the head *r* of the catch is removed from the notch *s* the parts C and D may be bent on each other, so as to form a right angle, or to any degree between a straight line and a right angle, as in Figure III., but only in one direction, the shoulders in the parts C, D, at *t*, *t*, preventing them from being bent in the opposite direction. Figure VI. is an edge view of the catch with the spring attached. Figure VII. is a front view of the same. The part D, Figures I., II., III., V., VIII., has a stud fixed in it at *u*; screw holes are made below *v*, and a loop is formed at the lower end, through which the part E, Figures I., II., III. passes. The part E has a hole, through which a headed screw *w* is passed into one of the screw holes in the part D to fasten the parts E, D, together, in the same manner as the parts B and C at *f*. The part E is narrowed and turned so as to form a right angle, the lower portion of which is formed into a screw *x*, Figure II. The part D has rivetted to it occasionally a thin steel plate *y* in Figure III. and V., to spread its influence over a larger surface of the limb when in use. Figure IX. represents a steel plate, having raised upon it a screwed hole, seen in section in Figure X. The holes in the plate 1, 1, are to admit the rivets. The screwed hole *z* is made to receive the screw *x*, Figure II., as seen in Figure IX. When the compound bar, Figure I., and its foot piece, Figure IX., are used for the distortion called in-knee, Figure XI., it is fitted up with padded bands or straps formed of leather or other appropriate materials. Figure XII., a compound padded strap. The part 2 is formed to pass through the long loops or mortices *d*, Figures I., II., III.; the part 3, to be buckled over the bar. Figure XIII. shews a knee strap to be passed round the limb over the compound bar at the knee. This may have when necessary two other straps to pass round the limb, as in Figures XVII. Figure XIV., one of the straps made to pass through the loops *c*, *c*, Figure I. Figure XV., a pad placed on the part B, as in Figure XVI. Figure XVI. shows the apparatus placed together ready for use. Figure XVII. shews the apparatus Figure XVI. as in use for the case Figure XI. The apparatus is made of a strength suitable to the age and size of the person requiring it, and by the shifting joints formed by the parts B, C, D, E, the compound bar may be altered in length at the pleasure of the operator. By tightening the strap, Figure XIV., as seen in application in Figure XVII., the front of the feet are turned inward by tightening the strap passed through the corresponding loops behind the body; the front of the feet may be turned outward by keeping the straps properly balancing each other according to the circumstances of the case. The feet are kept in their right position by lengthening the bar, Figure I., and tightening the strap 2, Figure XII., as seen in use in Figure XVII. The weight of the body is taken from the limb where the bar is locked, as shewn in this Figure, and by tightening the knee strap, Figure XIII., when applied as in Figure XVII., the knee is drawn toward the bar at the knee, while the ankle (supported by a strap carried round it, over the bar and buckle, as seen in this Figure, or when necessary) is prevented from being drawn outward too much by the introduction of a small pad between the bar and leg at the ankle, as seen in Figure XVI., or by other apparatus which I will now describe.

In many cases the simple arrangement of the parts of my apparatus above described is sufficient to effect a cure, the same being regulated from time to time to suit the varying circumstances of each case, care being taken also of the general health of the patients, but in others, in which the ankle is strongly thrown outward, additional parts are required. In these cases I use the parts shewn in Figure XVIII. and Figure XIX. Figure XVIII. is a front view of these parts, and Figure XIX. an edge view. F is a thin steel plate, curved and attached to the steel part G by a knuckle joint, at 4. The part G is made with or without a shifting joint, and has the lower end narrowed and bent to a right angle, and formed into a screw 5, Figure XIX. In extreme cases of in-knee a knuckle joint is formed in this part, at 6, Figure XX. When the parts Figure XVIII. or Figure XX. are used in connection with the parts Figure XVI. the foot part has two screwed holes formed in it, as seen in Figure XXI. and in section in Figure XXII., one for the reception of the screw, Figure XIX., XX., and the other for the screw *x*, Figure II., as seen in Figure XXIII. The part F, Figure XVIII., is padded and furnished with a leather strap, bellied, which is fixed upon the plate, as shewn in Figure XXIV. These parts are seen in use with the parts Figure XVI. in Figure XXV. In many cases the knee bends outward, and the ankle inward, as in Figure XXVI. For the cure of these I use the parts shewn in Figure XVI., with the addition of a pad placed on the inner side of the joint *i* of the bar, Figure II., as seen in Figure VIII., at 7, of such a degree of thickness as the case may require. When the leg bones are bent outwards also, as in Figure XXVI. A, or independent of out-knee, I apply the plate Y, Figures III. and V., so as to cause the knee and also the leg bones to be operated on at the same time, on the leg bones only when the knee joint is not involved in the complaint. Figures XXVII., XXVII., one shewing a front and the other a lateral view, exhibit the parts of the apparatus thus arranged in full operation. In a very bad case, Figure XXVI. A, of this kind, in which the parts are now restored to their natural line by the steady operation of the apparatus, the apparatus being regulated for that purpose by tightening the straps and altering the shifting joints from time to time, according to the judgment of the operator. When only one limb is affected, the strap, Figure XIV., is passed through one of the loops *c* in the part A, and is then carried round the pelvis or hips, and passed through the corresponding loop, and then returned upon itself and buckled. If only one limb of the part A is used, the strap Figure XIV. is carried through the loop and buckled round the hips. If the object be to turn the front of the foot outward the limb or part which projects backward when the apparatus is placed on the limb of the patient is used, and when the object is to turn the front of the foot inward the front part or limb of the lever is used. Another case is where there is such a degree of weakness in the muscles of the limb, or some of them, that the limb is rendered almost, sometimes quite, useless, without adequate support. When the front muscles of the leg have becomes paralysed, or nearly so, with more or less weakness of the muscles of the limb above the knee, the apparatus requires to be more complicated, in order to meet the circumstances, so as to increase the utility of the limbs, add to the comforts and diminish the clandication of the patient. I employ in such cases the parts shewn in Figure XXVIII. in connection with those shewn in Figure XVI. 8, Figure XXVIII., is a thin plate of steel, long enough to pass round the inner and back part of the leg, and curved so as to suit those parts. This plate is rivetted at 10 to the part 9, which is a bar of steel. At 11 a joint is formed with the part 12, which allows the parts 9 and 12 to turn upon each other. The movement is limited however by a strong pin or stud placed below the rivet 13 and 14, against which the projecting part 15 strikes when the parts 9 and 12 are brought to a given line (commonly straight) with each other. The part 12 is bent at a right angle at 16, and spread out to form a plate, as seen in Figure XXIX. 17 is a section of the part 12. This plate, when in use, is placed between the inner and outer soles of the boot, and has holes in it, 18, 18, to allow of its being rivetted to the leather. This plate may have formed in it or soldered on it a screwed hole, to admit the screw *x*, Figure II. When the screwed hole is formed with or in this plate the plate Figure IX. is not used in such cases, being superseded by the plate XXIX., having a screwed hole on its surface, of the form shewn at *z*, Figures IX. and X. When the muscles of the back of the limb have lost their power, or when the power has become so much diminished in comparison with that of those which bend the foot, that the use of apparatus is expedient to diminish the inconvenience experienced in walking, in such cases I employ the parts shewn in Figure XXX. These parts differ somewhat in arrangement from the arrangement necessary in the last case. The differences are these, videlicit:—The plate 8 is elongated anterior to the part 9, and curved so as to suit the front of the leg, and the catch 15 formed at the lower end of this part is placed before instead of behind the joint 11. In cases of extreme weakness of the muscles two straps are required, and are used as shewn in Figure XXXII. The parts seen in Figure XVI. in connection with those represented in Figures XXVIII. and those in Figure XXX. are shown as far as necessary for illustration in Figures XXXI. and XXXII., and when the muscles of the back and also of the front of the leg have lost their power, it is proper to carry the part 8 partly round the back as well as partly round the front of the leg. In such cases two catches at the joint 11 are necessary. The part 8 is padded and furnished with straps and buckles to fasten it to the limb. When the leg bones are bent forwards, as in Figure XXXIII., I use the parts shewn in Figures XXXIV., XXXV., and XXXVI., in connection with the parts shewn in Figure XVI. The steelwork in Figure XXXIV. is the same as in Figure XVIII. and Figure XIX., but padded and fitted up with straps and buckles, as seen in Figure XXXIV. Figure XXXV. is a pad composed of soft material, and fitted up with four straps and buckles, as seen in this Figure. Figure XXXVI. also is a pad of soft material, fitted up with straps and buckles, as here shewn. The buckles, as is seen, have two tongues, and the straps are strong web. Figure XXXVII. is a back view of the parts XXXIV., XXXV., and XXXVI., as seen in use in the case XXXIII., and Figure XXXVIII. is a front view. The manner of the application of the apparatus being shewn in these Figures, as for the case XXXIII., the action of the different parts is manifest. The effects must be modified according to the judgment of the operator The apparatus shewn in the group of Figures from I, to XXXVIII. inclusive, is that which I use in the above cases of deformity and local weakness, which are very common; varieties of such cases occur and require to be treated with corresponding modifications in the apparatus and their application, and these must be determined by the professional attendant upon the same principles, according to the number and extent of the parts involved in the complaint, and the accompanying circumstances observed in the particular case.

Distortions and deformities in the spine and chest, arising from disease or muscular weakness, or otherwise, are numerous and very various, and the apparatus employed in their correction or relief must also be numerous, and also varied to suit the circumstances of the cases as they occur. There are very few of these cases even when accompanied with structural disease that require to be treated by confinement in the inclined or horizontal posture, but a system of apparatus is necessary which might be modified and rendered suitable to the states or conditions of the several parts distorted or deformed, and such as can be made to produce such actions on and afford such defence to the bony structure as tend to bring the distorted parts into their natural positions, and to restore the deformed parts to their natural figure, while the general frame requires to be so effectually supported and sustained as to prevent the super-incumbent weight or the movements of the body from acting injuriously upon them. To provide for the difficulties met with in these cases, and to enable the patient to take exercise in the open air, I make use of the following portable apparatus, which I call my spine supports, and which completely answers these purposes, and also places the bones of the trunk very much under the command of the surgeon, and thereby enables him to carry on the curative measures in whatever posture the body may be placed, and whether the person be exercising on my exercising plane or other apparatus in the open air, or otherwise. This portable curative apparatus consists of two plates or standards of hardened and tempered steel, inflexible sideways, but capable of yielding back and front to the motions of the body of the patient. These plates or standards may be also composed of two or more pieces variously bent and connected to suit the circumstances of the various cases for which they are designed. One of these, as made of one piece of steel, is shown separately in Figure XXXIX. These plates may be made of steel thicker or thinner, agreeably to the state of the case, the age of the patient, or other circumstances. These plates are curved or bent so as to suit the particular form of the back or front of the body of the wearer, Figure XL. being an edge view of that intended for the back, and XLI. an edge view of that intended for the front of the body. This plate XXXIX. is first to be enclothed or encased within soft leather all over it. There is likewise prepared a clothing for the trunk or body of the wearer, and likewise to include or enclose these springs XXXIX. in the following manner:—The main portion of this clothing is composed of two thicknesses of woven cloth of cotton or other material, which may be strengthened when needful by introducing a layer of the stout hempen or linen cloth, commonly known by the name of brown holland. In general I prefer to use the cotton fabric known by the name of jean. Those pieces are stitched together in the manner commonly practised in stay-making, with gores if required, and a parallel groove or case is made to receive the spring in a situation so as to be placed in the centre of the front of the body of the patient. Previous, however, to their being stitched together, the parts beneath the spring, which are to be lodged or brought into contact with the body of the wearer, must have interposed between them and the body two, three, or more layers of soft woollen cloth or flannel, and be additionally strengthened with two layers or slips of stout brown holland cloth; the whole must then be stitched together so as to leave a space fit to receive the spring covered with leather for the front of the body, as before-mentioned. This spring is secured in the clothing by its being stitched or sewn together at top and bottom. The situation of the front spring XLI. is shewn at 19, 19, in Figure XLII. and in Figure XLIII. The clothing so described is not, however, made in one entire piece, but is formed in two or more, agreeably to the nature of the case. In Figure XLII. it is shewn as separable about the middle, the upper portion of it 20, 20, overlapping the lower part 21, 21, about one inch and a half, and is furnished with loops 22, which can be attached to buttons, affixed upon the parts 21 to receive them. These loops are formed partly of slips of india rubber, elastic cloth, or webbing, partly of leather, in which the loops are made. The leather is sewed or otherwise attached to the webbing or elastic cloth. These portions of india-rubber web are lodged within cavities formed within the thicknesses of the clothing, so as to allow them a degree of motion sideways, in order to accommodate them to the required and varying circumstances. These particulars are shewn by dotted lines in Figure XLII. To the upper part of the spring XXXIX. one or two metal buckles 23 are placed on each side. These are held in their places by a layer of brown holland and of jean, placed across the spring over the brown holland covering it, and previous to the different thicknesses of the clothing being all stitched together, the buckles resting on pads or cushions placed beneath them. There are also provided two shoulder parts 24, 24, shewn in Figure XLII., and one of which is shewn separately in Figure XLIV., but which, however, is adapted to the female clothing, and is connected with the upper part of the spring 19, 19, by the straps and buckles shewn in Figure XLIII. at 23. The shoulder parts 24, 24, have one or two stout cotton webbing straps attached to the front parts of them, as shewn in Figure XLIV. at 25, and in Figures XLII. and XLIII. I commonly use one for the female and two for the male.

The fore part of this clothing having been thus described, I shall now proceed to show how the back or hinder part of the apparatus is formed. Another steel spring plate or standard Figure XL., which is also enclosed, is provided. This is seen as padded and furnished with ten metal buckles and loops on each side in Figure XLV., and underneath the buckles there are placed two pads or cushions, which are in fact extensions of the coverings which form the pad and other parts lining the inner part of the steel spring. These are shewn in section on a larger scale, and as ready to be stitched together, in Figure XLVI., and as combined together by stitching in Figure XLVII. This back portion of the apparatus is united with one side of the fore part of it in the manner shewn in Figure XLII., the right side of which shews the fore part of the clothing buckled to the back part or standard, while the other straps in that Figure are shewn as ready to be so buckled. These straps are laid between the thicknesses constituting the part 20, 21, and are fixed by double rows of stitching. The parts 24, 24, which are shewn separately, as for the female figure in Figure XLIV., are to be covered where they come in contact with the armpits when in use, in the manner shewn in Figure XLII. at 26, 26, or by a section on a larger scale in Figure XLVIII., where is seen a piece of thick soft leather 25, stitched along the outer side, and then turned over the stitching and brought down to the part 24, Figure XLIV., and again secured by stitching, and thus leaving a pipe or tube through which is to be passed one of the rounded parts of two leather straps 26, 26, Figure XLII., one of which is shewn separately in Figure XLIX., and both are shewn as being in the parts in Figure XLII., these rounded parts enclosing within them short pieces of cord or twine for the purpose of giving substance and roundness to those parts. The ends of both these straps 27 are joined to the front standard 19, incased by metal buckles, shewn in Figure XLII. and XLIII. The shoulder part, Figure XLIV., is often used without the piped strap, Figure XLIX., in slight cases. Two other straps 29, 29, Figure XLII., are shewn as attached to the front clothing by buttons, and are brought round each thigh in the manner of the straps applied to trusses, and are then fastened or secured by the buckles 30, 30, as shewn in Figure L. In order to prevent excoriation they are covered with soft leather, as shewn in Figure XLII. There is likewise provided a cloth flap 31, which is affixed at the lower end of the spring 28 at the back, and is furnished with tapes or springs by which it can be secured by a button-hole made to receive the button affixed just above the buckles. Each side and the upper parts of this flat 31 are also stiffened by means of slips of whalebone introduced within pipings or tubes, or places provided to receive or retain them. Figure LI. shows a neck spring seen in its widest part. 32, holes for sewing the soft material to the top of the springs. 33, cogs. Figure LII. and LIII. edge views of this spring. The spring Figure LI. is received into a box formed in the following manner:—A thin plate of steel is taken, Figure LIV., and on it is laid a slip of steel, Figure LV., as seen in dotted lines at 34, Figure LIV. On the opposite side, at the top, is placed another small portion of steel of the same thickness, Figure LVI., also indicated by dotted lines at 35. On the lower corner 36 of the plate, Figure LIV., is placed a spring, Figure LVII. There is then introduced a catch, LVIII. at 37, and on these parts is laid the plate Figure LIX., which is fixed to the other parts by rivetting, as exhibited with a neck spring, introduced in Figure LX. Figure LXI. shows the form usually made for the front standard Figure XLI., and Figure LX. is the usual form placed on the back standard Figure XL. Figure LXII. shows the plate as reversed, the catch Figure LVIII. and the spring Figure LVII. being also reversed when this form is used. The parts being thus arranged, pressure of the thumb on the catch at 38 will cause the catch to turn on its axis, and the tooth or head of it 39 to be drawn from the cog 33, Figure LI., and then the neck spring may be shifted or withdrawn; and as soon as the pressure of the thumb is removed, the spring Figure LVII. acts on the part of the catch 38, and forces it back again into the box, where it prevents the neck spring from shifting. Figure LXIII. shows the end of the box. Figure LXIV. exhibits the side of the box opposite to that in which the catch is placed. Here the box is seen on two small portions of steel, which are sometimes used in order to allow the neck spring to pass into it over a nut and screw, presently to be described. These portions, Figures LXV., LXV., are made of a thickness to answer the purpose intended. When the box is completed it is laid on the covering of the standard Fig. XLI. at 40, in Figure L., and riveted through this part of the covering to the standard. The inner part of the covering is then replaced over the part of the standard intended to lie nearest the back, and stretched so as to cover up the spring or standard completely, the padding described being so placed as to cover the inner surface to defend the body from being fretted by the hard material of which the standard is composed. The parts, Figure LXV., are only used when room is wanted to allow the neck spring, Figure LI., to pass freely into the box. They are always necessary, however, when the screwed nut, presently to be described, is used on the top of the front standard. Figure LXVI. the same as Figure LX., but showing a form of neck strap, the ends of which are received by metal buckles placed at the top of the neck springs, one of which is seen buckled in this Figure. This strap is composed in the following manner, namely, a portion of steel, from one inch and a half to two inches and a half long, and slightly curved, is placed on a piece of strap webbing, on this is laid a piece of strong cardboard, and on this two or three layers of flannel or woollen cloth, and over this a piece of soft leather; the outer surface may then be covered with black silk or other material, and the whole stitched together to form the neck strap here represented. The parts shown in Figure LI. to LXVI. inclusive, constitute the neck parts of my apparatus, which I commonly use in such cases as do not require the neck apparatus to be more complicated, but in some cases, presently to be mentioned, other parts are necessary, as will be hereafter shown. In the use of my spine support, as above described, the lateral antagonizing actions, by which the lateral curves of the spine are connected, exert more or less influence on the front of the chest, so that it would be necessary to use it with very great caution, in order to prevent the chest from being contracted in the anterio-posterior direction. This effect of the apparatus renders it necessary to limit its lateral bearings much more than is desirable in many cases, and in some its influence could only be permitted to be very inadequate for the reduction of the curvature. In order to get over this inconvenience, and to protect the chest from pressure in its anterio-posterior direction, I invented what I call a chest guard, by which the evil here mentioned is entirely prevented. The chest guard is a curved spring, shown in Figure LXVII. 41, 41, are studs screwed into the springs. Figure LXVIII. is a section of the chest guard on a full size scale, and Figure LXIX., a portion of one end of it. 42 are holes in the chest guard for attaching the soft material or covering to it by sewing. When the guard is in use the studs 41, 41, are received into the holes 43, 43, in the plates of the boxes, Figures LX., LXI., one stud being placed in a hole in the front plate and the other in a hole in the back plate or cover of the boxes respectively. In certain stages of lateral curvature of the spine accompanied with torsion, which causes one side of the chest to project backward and the other forward, it is important that every action which is calculated to resist the return of the spinal bones to their natural relative position, and also the sides of the chest, should be removed, so that as the surgeon reduces the lateral curvatures by the operation of the means employed, the tortion, which is a consequence of the lateral curves, may be at the same time also removed. In my apparatus, as above described, the parts of the chest which had become flattened from the effects of the curvature receive part of the pressure employed to aid in the reduction of the lateral curves; for instance, when the right side of the chest projects backward, the latero-anterior part of the same side is commonly more or less flattened, and on the left side the anterior part projects forward, while the latero-posterior part is more or less hollow and flattened. In such cases, though the soft parts of the support in action operates more upon the latero-posterior and latero-anterior projections than upon the opposite hollowed and flattened parts, yet the hollowed and flattened parts on the convex sides of the spinal curves especially are not free from the pressure. and, consequently, the favorable influences of the supports made to reduce the lateral curves and to remove the consequent torsion of the spine and chest would be hindered in effecting the latter object by the pressure exerted by the support on the hollowed and flattened parts on the convex sides of the curves as well as on the projecting parts, though, as I have said, in a less degree on the former than on the latter. To remove this impediment to restoration, I invented additional springs or levers, to be used with the support in such a manner as to protect the hollowed and flattened parts from pressure, and at the same time to aid in the removal of the anterior and posterior projections of the chest through the medium of the soft material, by producing an action upon them more calculated to draw the ribs into their natural relative positions, and thereby to remove also the torsion of the spine. Figure LXX. shows the broadside of a cross back spring, and Figure LXXI. an edge view of the same. 44 are holes for the attachment of a strap, as seen in Figure LXXII. When this spring is in use, the curved end 45 is received into the mortice 46, Figure LX., and applied as will presently be shown. Figure LXXIII. is a back lateral spring. Figure LXXIV. is an edge view of the same, bent. Figure LXXV., the same, covered or enclosed in cotton jean or other soft material, and fitted up with strong webbing straps. Figure LXXVI., a variety of the same widened in one part to adapt it to the condition of the parts. Figure LXXVII. is a shoulder spring represented in its broadest view; the spring is hollowed out a little at 47 to cause it to lie easily on the front of the shoulder when padded. 48 are square holes to receive the shoulder screw shown in in Figure LXXVIII. 49 are round holes to receive the projecting holed screw 50 formed in or on the front standard, Figure XLI., of the support. Figure LXXX., edge view of the shoulder spring. Figure LXXXI., a front lateral spring. 51 is a hole to receive the screw Figure LXXXVIII., which passes through the spring Figure LXXVII. at 48, and the spring, Figure LXXXI., at 51, and is received by a screwed nut, which works on a washer and binds the springs together, as seen in Figure LXXXII. Figure LXXXIII. and Figure LXXXIV. are edge views of the springs, Figure LXXXI. Figure LXXXIII. is a form for the male, and Figure LXXXIV. for the female. Figure LXXXV. is the spring, Figure LXXXI., widened at one part; this is done by a very thin plate of steel, which is rivetted to the spring. The front lateral spring, Figure LXXXI., and also the back lateral spring, Figure LXXIII., are made of various curves, and twists, and widths, and strengths, to suit the condition and size of the parts, according to the judgement of the surgeon or operator. Figure LXXXII. shows a front lateral spring fastened to the shoulder part Figure LXXVII., and fitted up with straps, both springs being encased or covered with cotton jean or other soft material. 52 is a web strap stitched to the shoulder part, and received by a buckle fastened to the support at 53, Figure LXXXVI. 54, 54, 54, in Figure LXXXII., are straps stitched on the side spring, and received into the buckles stitched to the support, as seen in Figure LXXXVI., at 55, 55, 55. The end of the spring LXXVII. is seen in Figure LXXXVI. fastened to the holed screw, shown at 50 in Figure XLI., by means of a broad notched beaded screw, seen in Figure LXXXVII. The parts elucidated and shown in Figures from XXXIX. to LXXXVII., inclusive, are seen in operation in Figure LXXXVI. and LXXXVIII. In Figure LXXXVI. is seen the front neck spring, the chest guard at 57, the shoulder piece 58, and front side spring 59, in use with the other parts of my spine support already mentioned. At 60 the neck spring, Figure LI., is seen passing over the screw Figure LXXXVII., which is shown in place by a dotted line. The front lateral spring is seen passing under the upper and middle pieces of the soft material of the support, and its situation is marked by a dotted line. In Figure LXXXVIII. is seen the situation of the cross back spring, Figure LXX., 61, with one end passed into the mortice 46 of the plate, Figure LIX., and the other end passing under the shoulder piece of the soft material 62, its situation being marked by dotted lines. Here the upper end of the back side spring Figure LXXIII. rests upon it. The back side spring in this case is passed under the shoulder piece as well as the middle piece of the soft material, as marked by dotted lines at 63, and over the back part of the chest guard, and its upper end is seen at 64. The situation of the back side spring under the soft material is seen by the dotted lines. The manner of connecting the cross back piece and the back side spring together is seen in Figure XC., where the strap, seen in Figure LXXII., of the cross back spring is shown passing round the back side spring and brought out ready to be received into a buckle attached to the soft material of the support under the arm at 65 in Figure LXXXVIII. The position of the back side spring under the soft material can be regulated by means of the straps attached to it, as in Figure XC. One of the ends of the upper strap is received by the buckle under the arm, and the other by one of the buckles fastened to the back standard of the support, to which the box Figure LX. is attached. One of the ends of the lower strap 66, Figure LXXV., is received by a buckle stitched to the support 67, in Figure LXXXVIII., and the other by one of the buckles connected to the back standard of the support. The cross spring Figure LXX. is commonly made straight to the crooked end; but when the arrangement of the parts which have been shown is required, it may be bent if necessary, the object being in certain cases to prevent the back side spring from pressing upon the shoulder. When the widened back side spring Figure LXXVI. is deemed necessary for the better protection of the parts, it can be fastened to the cross bar spring by a headed screw and a nut, as seen in Figure XCI. This prevents the additional cross parts 68 from being thrown too close to the chest by the action of the soft material pressing on it. By the arrangement of the back and front side springs with the shoulder spring and cross back spring, as shown in Figure LXXXVI. and Figure LXXXVIII., the hollow and flattened parts of the chest arising from lateral curvature are effectually preserved from pressure, while the side springs or levers operate so as to aid, through the medium of the soft material, in the reduction of the corresponding projections of the back and front of the chest. Two other advantages are derivable from the arrangement and form of the front side spring and shoulder piece, namely, the breast in the female is defended from pressure, which is of great importance, and the shoulder, which is thrown unnaturally forward by the deformity of the back of the chest, is pressed gradually back to its natural situation by the operation of the shoulder spring upon it, the shoulder spring itself being acted upon more or less powerfully by the front side spring, so as to produce this effect. The chest guard is made of sufficient span, strength, and temper to preserve the front of the chest from all pressure, or to any extent that may be consistent with the curative intentions of the operator. There are many cases of lateral curvature of the spine, however, which cannot be cured even by the improved apparatus above described, as when the deforming process has proceeded to a great extent and the spine and ribs have become strongly fixed in their distorted positions, and the particular bones altered in form, producing lateral, anterior, and posterior projections, with corresponding concavities and other irregularities in the contigmation of the parts involved in the complaint. In such cases it is necessary to produce a combined series of action of sufficient power to meet and overcome the increased difficulties which present themselves, and which cannot be done as far as the condition of the parts will allow by any combination of the apparatus hitherto described. The actions must be positive on all the unnatural projections in directions tending to reduce the projecting parts to their natural position in the body, while, in order that the positive influence of the apparatus may not be impeded, all the unnaturally hollowed and flattened parts are preserved perfectly free from pressure. Figure XCII. is a shoulder piece, the same as shown in Figure LXXVII., but with an addition of a thin plate of steel rivetted to it at 69. This part 69 is bent, as is seen in section in Figure XCIII., or more or less to suit the figure of the part of the chest near which it lies when in use. This shoulder spring is encased in soft material before it is applied, and has formed at the top of the steel part 69, or in the soft material, a long loop.

Figure XCIV. represents a back side spring longer than that represented at Figure LXXXIII., and having holes at the end 70 to admit the threads used in stitching a web strap 71, Figure XCV. to it at this part. The spring is shown encased in soft material, and the straps seen crossing the spring in this Figure are the same as those seen in Figure LXXV. Figure XCVI. is an edge view of this spring. Figure XCVII. exhibits the long back side spring, Figure XCV., in use in connection with that shown in use in Figure LXXXVIII. and other parts. Its situation under the soft material of the middle and shoulder piece of the support is marked by dotted lines. The spring being placed as is seen in the Figure XCVII., the webbing strap 71 is carried across the shoulder, and is then passed through the loop formed in or on the part 69, Figure XCII., as seen in Figure XCVIII. at 73. This strap 71, is then returned upon itself, and carried over the top of the spring under a loop or stay formed in the soft material, and as seen at 74, Figure XCVII. It is then carried down and is received by a metal buckle stitched to the support at 75. The cross straps 76, 76, are buckled in the following manner:—One end of the upper strap is passed under the back standard of the support, as marked by dotted lines at 77, and is then received by one of the metal buckles of that standard at 78. The other end is received by a buckle stitched to the part of the shoulder piece of soft material, which is under the arm, and is indicated at 79. One of the ends of the lower cross strap is received by a buckle stitched to the lower piece of the support at 80, and the other by one of the buckles 81 stitched to the material covering the back standard, in the same manner as the spring, Figure LXXV. in Figures LXXXVIII. and as also seen in this Figure XCVII. It is to be observed that padding composed of woollen fabric or other soft material is introduced under the bearing parts of the lateral and other springs, of sufficient thickness to prevent the skin from being injured by their pressure under judicious management. The thickness and situation of the pads must be regulated according to the condition of the parts and the object of the operator, no one thickness or position being applicable to every case. In Figures LXXXVI. and LXXXVIII., the back lateral spring Figure LXXV., and the front lateral spring Figure LXXXI., as attached to the metal shoulder piece or spring, are represented as in use to defend the hollowed and flattened parts of the chest from pressure, but the back lateral spring Figure XCV. is seen in use in Figure XCVII., in such a manner as to enable the surgeon or operator to produce any degree of pressure on the part or parts of the chest of the same side projecting backward, with a view to press the ribs forward to their natural relative positions, that may be consistent with the condition of the parts and safety of the patient. The front side spring being confined at the lower end, as seen in Figure LXXXVI., or in any other manner, and the lower end of the long back spring Figure XCV., as shown in Figure XCVII., or otherwise, the tightening of the strap 71, passed over the shoulder as above mentioned, causes the spring Figure XCV. to exert a direct influence on the projection of the side of the chest, tending to force the ribs forwards into their natural relative position, in any degree that may be consistent with the safety of the patient, the hollowed and flattened parts of the front of the ribs arising from their alteration in form, and from their incroaching unnaturally upon the cavity of the chest, being protected from pressure by the front side spring, as indicated in Figure LXXXVI. There is no impediment offered by the support to the reduction of the ribs to their natural form and position under the action of the long side spring, as seen in use in Figure XCVII. If the front side spring were suffered to operate on the latero-anterior part of the chest, at the same time that its opposite back spring is operating on the latero posterior, a force may be used sufficient to crush the side of the chest, provided the straps and levers were made strong enough; but as the front spring is defending the front of the chest from pressure, while the long back spring is operating on the posterior projection, the effect tends to undo the torsion of the spine by the action of the spring on the ribs, and to restore the natural figure of the chest. The application of my apparatus as last described enables the surgeon to employ a degree of power sufficient to overcome the difficulties which present themselves in many cases, but there are others in which it is not enough to operate on the latero-posterior projections of the chest, leaving the front of the corresponding side and the other side of the back of the chest free from pressure, as shown in Figure XCVII. and XCVIII., but an action corresponding in kind with that exerted on the latero-posterior projection must be made to operate on the other side of the latero-anterior part of the chest, where the ribs project forwards, and in such a manner that the flattened parts of the corresponding sides of the back and front of the chest may be left free from pressure. In order to accomplish this I introduce another lever or spring, similar in kind to that shewn in Figure XCIV. This is bent, and formed to suit the configuration of the latero-anterior region of the chest at the part on which it is to operate, and then encased in soft material, as is described and shewn in Figure XCV., but with this exception, namely, it has a loop formed in the steel, or in the soft material at the top, as shewn in Figure XCIX. The back spring or lever Figure LXXIII., as seen in use at Figure XCVII., is also made longer, and formed at the top 70 like

Figure XCIV., and has a web strap attached to it, as shewn at 71, Figure XCV. These parts being provided as here described, and bent, twisted, widened, and padded, so as to suit the state of the parts and size of the patient, they are to be used in the following manner, videlicit:—The encased spring furnished with straps, Figure XCIX., is to be introduced under the middle and shoulder pieces of soft material, as indicated by dotted lines in Figure C, and fastened at the lower end 82 by buckles, as seen in that Figure or otherwise. One of the ends of the top strap 83, Figure XCIX. is carried under or below the front standard of the support, as indicated by dotted lines, and is received by a metal buckle at 84, and the other end is carried under the arm, where it is received by a buckle stitched on the soft material forming the shoulder part, Figure XLIV., at 24 of the support. The spring being thus placed it can be fixed in the exact position required by means of the cross straps and their corresponding buckles. The back lateral spring, fitted up as shown in Figure XCV., having been introduced under the soft material forming the middle and upper parts of the support, and over the cross back spring Figure LXX., as indicated in Figure CI., the web strap affixed to the upper end of it, as described, is carried across the shoulder, passed through the loop 85, Figure XCIX., as shown at 86, Figure C. The strap is then returned upon itself, passed through a loop affixed to the top of the back lateral spring, as exhibited at 87, Figure CI., and is carried down to the side of the support, where it is received and fixed by a buckle at any degree of tightness that the circumstances of the case may indicate. The straps fixed across this spring are received by buckles, and by these means this spring is fixed in the desired line on the latero-posterior part of the chest, in the same manner as has been described in speaking of the spring or lever Figure XCV., and indicated also in Figure CI., one of the ends of the top cross strap being received by a buckle under the arm, and the other carried between the body and back standard, to be received by a buckle on the side of that standard at 88. The lower end is confined, as is shown in this Figure CI., or in any other convenient manner, the object being to fix the lower end in a proper line, and to prevent it from rising, so as to destroy or diminish the influence of the spring when its upper end is acted upon by the strap attached to it, and as shown in use in this Figure. By the arrangement of the levers or springs, as seen in Figure C. and CI., the posterior part of the right side of the chest may be pressed forward, and the anterior part of the left side pressed sumultaneously backwards, in such a manner as to remove the torsion of the spine, and to restore the ribs to their natural relative position; the anterior part of the right side and the posterior part of the left side being at the same time defended from pressure. It sometimes happens however that the spine turns upon itself in different directions, so as to carry backward one part of the side of the chest, and forward another part of the same side, and in this way in some cases there is found on one side of the back of the chest one projection, and on the other two, while the front of the chest partakes of the same kind of irregularity. To meet these circumstances of these cases a modification in the application of the latero-posterio and laterio-anterior levers is required. In these cases the cross back spring Figure LXXII., seen in use in Figure LXXXVIII., is omitted, and the latero-posteror springs are so bent and padded that when they are fixed in their proper places they can be made to operate on all the unnatural projections on the back of the chest on both sides at the same time. This is done by tightening the straps which connect these levers with the latero-anterior levers across the shoulders. These springs being fixed along the latero-posterior regions of the body, one made to perform the double office of operating on the posterior projections, and of defending the depressed and flattened parts of the back of the chest from pressure, the clothing or soft material of the support connected to the back standard being so arranged as to cause the levers thus to operate. The pads used must as above stated be placed under the bearing parts of the levers, or, in other words, on the projections. The regulation of the actions must be left to the judgment of the surgeon. The manner of introducing the springs, and their situation, is indicated in Figure CII., but this is varied as the circumstances of the case may require, the principle of operation being the same in all. In some cases of the description last mentioned, instead of carrying up the latero-anterior spring to the base of the neck, it is expedient to introduce another cross shoulder spring or lever, with a view to protect the other part of the side of the front of the chest from the influence of the latero-anterior lever at this part, while it is made to operate on the lower part on the same side. This is done by placing the upper end on a cross shoulder lever, as is shewn in Figure CIII., and as is seen in Figure CV. without the head and neck apparatus. Again, in some cases, the opposite side of the top of the front of the chest requires to be acted on, while the lower part is required to be protected from pressure. This latter object may be obtained by the introduction of a pad under the lever, where it joins the shoulder spring or lever, of sufficient thickness to produce this effect, while the lower end may be kept from the body by a cross lever connected to the lower part of the front standard, as seen in Figure CIII. at 89, where one end of a lever similar to that shewn in Figure LXXII. is received by a long loop formed in the edge of a steel plate rivetted to the front standard. The lever rests on the front spring or standard, and is extended towards the side, so that the lower end of the latero-anterior lever may rest on it and be confined in its proper situation by straps and buckles, as exhibited in this Figure, where is shewn one of the cross levers, as seen in Figure CIII. at 89. Should it be required, the transverse shoulder levers may at any time be removed and the latero-anterior lever be carried up to the base of the neck, in the same manner as indicated in Figure C, the lower end being fastened by straps and buckles or placed on a transverse lever, as shewn in Figure CIII., as may be most expedient according to the circumstances of the case. In some cases there is much special deformity of the chest in connection with deformity of the spine. This is produced by other causes than spinal deviation and often exists without it. Sometimes the chest projects strongly forward at the centre of the upper part, while the sides and lower parts are much contracted and flattened or depressed. In such cases the apparatus is so arranged as to meet the circumstances which present themselves. The chest, where it is contracted and depressed, must be defended from pressure, while the upper projecting part must be gently borne upon by the apparatus. To answer these indications in connection with those which must be met for the restoration of the spine and the deformity of the chest occasioned by it, I apply the latero-posterior levers so as to aid in removing any posterior projections of the chest which the lateral curvature may have occasioned; sometimes the arrangement of these levers as is seen in Figure CI., sometimes as shewn in Figure CII., the principle in all these cases being to use them in such a manner as to cause them to bear upon the unnatural projections, and at the same time to defend the depressed or flattened parts from pressure. The latero-anterior levers above described are made to rest on two shoulder levers in such cases as seen in Figure CIV. By this arrangement it will be seen the upper projecting part of the chest may be acted upon with any degree of force that may be consistent with the safety of the patient, with the latero-anterior and lower parts of the chest are kept entirely free from pressure. The degree of pressure is regulated by the straps which connect the upper ends of the latero-posterior levers with the shoulder levers or springs, & as seen exhibited in this Figure CIV. Under their lower ends cross levers may be placed as indicated in Figure CIII. at 89, or hard leather if required. The object of placing the lower ends of the levers on cross levers when in use, or introducing a piece of hard leather under them, is the more effectually to defend the abdomen from undue pressure or to defend the lower anterior parts of the sides of the chest from pressure more effectually. In most cases the arrangement of the lower ends, as seen in Figure 3, is all that is necessary. In other respects the apparatus is used as in cases of spinal curvature unconnected with special deformity of the chest. In some cases where there is special deformity of the chest in connection with deformity of the spine, I use my chest corrector, Figure CVI. This is a thin plate of steel bent to the form of the chest, and narrowed and extended at the angles so as to form the four arms 90, 90, 90, 90. At the extremity of each of the upper arms is formed a long loop in the steel 91, 91, or loops may be formed in the soft material with which the chest corrector is covered. The lower arms and the centre of the lower end are pierced with small holes for the purpose of receiving the thread used in stitching the webbing straps 92, 92, 92, to them. The chest corrector may be used for the removal of projections in one or more parts of the chest at the same time, whether they exist in the front or the latero-anterior region. Before using the chest corrector I pad the parts of it which are destined to bear on the unnatural projections, and then apply it under the front standard, and wholly or in part also under other parts of the support. Its situation is shewn by dotted lines in a front view in Figure CVII. By using the latero-anterior levers in connection with two shoulder levers, as seen in this Figure, and the chest guard, the front of the support may be prevented altogether, if desirable, from pressing on the chest corrector. One or both the latero-anterior levers may be also used to aid in determining the action of the chest corrector, especially on a given part; for instance, if the object be to apply pressure across a large portion of the upper part of the front of the chest, the lower arms of the chest corrector would be placed so as to lie on the latero-anterior springs or levers, as indicated in Figure CVII. If the object be to apply pressure to a given part of the side of the chest near the breast bone, one of the lower limbs may be made to lie on one of the latero-anterior levers, while the other is placed between the latero-anterior lever on the other side and the chest. When the chest corrector is properly arranged in connection with the spine support, one of the web straps 92 is carried down behind the front standard of the support, and turned upon itself over the lower end of that standard, and then passed through a loop to be received by a buckle, as shewn in Figure CVII. The other two web straps 92, 92, are passed round to the back of the chest, over the latero-posterior levers, to which they may be connected by a turn of each strap over the lever of the corresponding side, and then fastened together by buckling, as shewn in Figure CVIII., where the latero-posterior levers are seen in action. The web straps affixed to the upper ends of the latero-posterio levers are passed across the shoulders at the base of the neck, passed through the loops formed in the upper arms of the chest corrector at 91, 91, Figure CVII., and returned on themselves, and buckled as indicated in Figure CVIII. When the apparatus is thus arranged the chest corrector may be made to exert its influence according to the intention of the operator, by tightening the straps attached to the arms of it. If the whole of the metal part of the chest corrector is placed under the front of the spine support, with the latero-anterior levers attached with shoulder levers or springs, as above described, the tightening the straps passed through the loops of the upper arms, and those attached to the lower arms equally, the whole of the front of the chest may be borne upon, or such unnatural projections at this part as it is the object of the operator to reduce. If the straps attached to the lower arms be loosened, and the straps passing through the loops of the upper arm be tightened, the upper part of the chest will be the principal seat of action. If the straps connected with one side of the chest corrector be tightened, and those connected with the other side be loosened, one side of the chest will be principally acted upon.

The chest corrector having been described, and several modes of using it pointed out, the condition of the parts in special cases will indicate any variety in its application in connection with my spine support that may be necessary, and these must be determined by the judgment of the operator. In many cases there is more or less projection of the spine backward accompanying lateral curvature. In these cases the shoulders and upper part of the trunk are inclined forward. In order to aid in the removal of this defect in the figure, I employ braces in connection with other parts of my apparatus. These consist of pieces of cotton, jean, or other soft material, narrowed and padded at one end to prevent it from injuring the skin of the arm-pit. To this part is attached a strap, or a strap furnished with a buckle. Figures CIX. shew the form of braces which I employ. The broad ends 93, 93, are affixed to the covering and pad of the back standard by stitching or otherwise. At 94, 94, thin slips of whalebone are introduced to keep the soft material spread out at this part. At 95, 95, Figure CIX., they are rounded and padded. Figures CX. exhibit the braces in use in connection with other parts of my spinal apparatus. They are shewn buckled together on the back of the support at 96. By tightening the braces the shoulders are drawn backwards, and the upper part of the trunk made to approach the back standard of the support without interfering with the curative influence of other parts of the apparatus. In some cases the spinal curative extends to the neck in such a manner as to form a lateral curve in the neck, throwing the head forward or to one side, so that the apparatus described are not sufficient to sustain the neck and head in their erect position, or to aid materially in removing the deformity at this part. In these cases it is necessary to extend the support to the head. This I do in the following manner, videlicet:—The chest guard Figure LXVII. is formed as represented in Figure CXI., and has a thin plate of steel moulded to the side of the head and fastened upon it so as to admit of a limited rotatory movement, and as shewn in this Figure CXI. The plate which I call the head plate is padded with woollen material, so that it may be made to bear against the side of the head without producing distress to the patient. The chest guard thus formed and furnished is used as seen in Figure CXII. The ends being placed in the holes of the neck spring boxes the plate is brought to the side of the head and made to exert a lifting action, by a strap and buckle stitched to each neck spring. When this form of guard is used each neck spring has affixed to it two buckles and one web strap. The strap is carried round the limb of the chest guard, and then returned upon itself and buckled to its proper buckle. This having been done before and behind, the guard may be drawn against the side of the head with the desired degree of force to influence the upper end of the curve, while the convex side of it is operated upon by the neck strap which confines the two neck springs together, in the manner indicated in this Figure and shewn in Figure CIII. When the head is thrown forward, in consequence of a posterior curve, I use the head apparatus Figures CXIII., CXIV., CXV. The toothed part Figure CXVIII. is formed to be received into the box formed as for the neck spring, and as above described, but rather deeper, to admit this part of the head apparatus, which is made thicker and stronger than the ordinary neck springs. The end 97 is bent and formed into a pivot, on which is placed the part Figure CXIV., and which has a hole in it at 98 to receive it. The standards 99, 99, are formed on the part Figure CXIV. so that they may be shifted at the pleasure of the operator, and fixed by means of screws 100 passing through them and pressing against the part on which they are placed. The parts Figures CXIV. are furnished with straps suited to the back of the head and chin, and are shewn as in use with the part CXIII. in Figure CXVI. This arrangement for supporting the head may be exchanged at any time for the parts Figure CXV. The toothed end 101 is in like manner received into the box rivetted to the back standard, and the bowed part is placed so as to be over the head. The part 102 hangs on this, its position being fixed by a screw which passes through the part 103, and is screwed down between the notches 104 in the part on which it is placed. A swivel is formed at 105 on which the part 102 moves freely in a rotary direction with the movement of the head. This arrangement being fitted up with straps is seen in use, Figure CXVII. When there is a particular projection of the spine backward, as from disease or weakness, and where there is great tenderness, as in some cases of spinal irritation, I use two levers to form the back standard of the support, of half the width of that standard when made of one lever. When two levers are employed they are encased and padded as when one is used, with this exception, however, viz.:—They are separated from each other by stitching, and when the box Figure LX is required to be used with them, they are joined by two cross portions of metal at the upper ends which are rivetted to them; on these cross pieces the box is rivetted, and the rivets are afterwards covered by the common pad of the back standard, the soft material being stitched round the incased metal parts as indicated or described. Figure CXVII. shews a support in use, with two levers in the back standard, and with head apparatus applied. The compound jointed standard composed of a series of levers, Figure CXVIII., is applicable in some cases. This is composed of narrow thin plates of steel jointed together, so that each of the two upper and lower pieces may turn freely on axes, leaving the outer ends free, and all the other pieces are connected together, as shewn in the Drawings). When this compound standard is used one is employed for the back of the trunk and one for the front of it. The lower pieces one elongated, as shewn in this Figure, and the two upper may terminate where they cross each other at 106, or where they join the next levers. One or both of the top levers may be bent and carried to the neck, or to the head, and used as the circumstances of the case may indicate. The compound jointed standards thus formed are furnished with stiff leather padded and fixed to it in the manner following, videlicet:—Figure CXIX., a piece of hard leather broader at the lower end, where it has a hole formed in it 107. Above this hole is a long hole 108; near the top is another long hole 109, which is made longer than the last. The hole 108 is required to be about an inch and a half in length, and the whole 109 about three inches long. The edges of the holes are strengthened on the sides by thin narrow plates of metal let into the leather, and fixed by rivetting or otherwise; the side presented to view in the Drawing is that intended to be placed nearest the body. The compound jointed standard Figure CXVIII. is fixed to this leather in the following manner, videlicet:—Three square pins, each of which has an enlarged head on one end, the other end of each pin being formed with a screw to receive nut 112, Fig. 121, between which and the enlarged head the edges of the holes in the leather are enclosed, while the pins being square are thereby prevented turning in those holes. The square pins are formed with a female screw to receive a screw pin 114, by which they are screwed to the standard, as is shewn on a larger scale in Figure 121. The square pins are made to fit the width of the holes in the hard leather, Figure CXIX., so, however, that the two intended for the holes 108, 109, may slide easily along these holes. These several parts having been prepared, the square pins are introduced as above described with respect to Figure 121. The leather is then padded with woollen cloth or other material, and fastened to it by stitching. The compound jointed standard properly fitted up, as will be shewn, is to be then laid on the leather, and the screws 114, made to fit the female screws in the square pin, are then passed through the centre joints 100, 100, 100, into those female screws placed ready to receive them, and the whole are fastened together so as to allow the square pins in the holes 108, 109, to traverse the length of those holes when the compound standard is elongated or shortened. Figure CXX. shews the compound standard thus fixed on the leather, having buckles attached to the ends of the levers at the lateral angles, and to the two lower levers to the two upper ends, and of the two upper levers as for the back parts. Figure CXXI. is a section of the leather as padded for use on a larger scale. The padding of woollen cloth or soft material is so placed as to leave the head 111 of the square pins free, as seen in this Figure 113, a line shewing the situation of the compound jointed standard between the nut and screw pin 114. The manner of fixing the buckles to the lateral angles is shewn on a larger scale in Figure CXXII., where the buckle is seen fastened to the end of the levers, forming the lateral angles, by soft thin strong leather. One end of the leather attached to the buckle is divided into three parts, which are passed round the ends of the levers at the angles doubled upon themselves, and are then stitched to the leather situated between the ends of the levers, and the metal buckle by two rows of stitching; stitches are also passed through the leather and the holes seen in the ends of the levers to prevent the buckles from slipping from the ends of the levers to which they are attached. Figure CXXIII. shews the manner of fixing the soft material or clothing for the body to the front compound jointed standard. Layers of cotton, jean, or other cloth is used for the clothing, two of which are toothed where they are to embrace the ends of the short levers, and through the whole length of the front and back parts, and as will be presently shewn. Two of the ends of the cloth so cut are made to embrace the ends of the levers, as seen in this Figure, and are there stitched to each other by a small row of stitching, between which are placed a portion of whalebone 115. When necessary the attachment of the cloth may be further strengthened by narrow tape passed over the ends of the levers, and stitched in by the stitching which confines the two layers of cloth together. Stitches are passed through the cloth and the holes near the ends of the levers to keep the cloth from shifting from its proper places. The outer layer of the cloth is not directly attached to the ends of the levers, but is strengthened at the edges in the line of the centre joints of the standard in the manner in which stays are usually strengthened at the same parts by casing and thin flat springs or whalebone. Figure CXXIV. shews the two under layers toothed and affixed to the ends of the short levers of the compound standard intended for the front of the body, and which is shewn as secured to the stiff padded leather, as has been described, the upper portion of the clothing being confined to the upper ends of the short levers by buckles and straps, as seen in this Figure, or they can be confined, when required, to the two upper lateral angles by the same means. In this Figure two buckles and two straps are seen as fixing the upper or shoulder portion of the clothing to the levers which form the upper lateral angle on the right side 116, and on the left side the clothing is not attached to the corresponding angle 117. The arrangement at this part shews the attachment of the clothing for the male on the right side, and for the female on the left. The clothing is attached to the lower ends of the lower levers by buckles and straps; a strap 118, with a buckle, is passed through the two lower loops of the lower levers to draw them toward each other, and so to elongate the standard, as may be required. The whole standard is supported at its proper degree of elongation by the action of this strap 118, and by the straps 119, 119, affixed to the lower ends of the lower levers, and the buckles stitched to the support at 120, 120, as seen in Figure CXXVII. The two layers of the cloth being properly affixed to the front standard by stitching, and with buckles and straps, the third or outer layer on each side is brought over the standard, and the two sides are then laced together, as seen in Figure CXXVI. and CXXVII. The two layers of the cloth, which are toothed or notched in front, are also toothed or notched behind, but instead of the teeth being fixed by stitching to the back standard, webbing straps are introduced through the whole length between the layers forming each tooth, and firmly secured by two rows of stitching, between which a thin spring, or a thin portion of whalebone, is encased between the two layers of cloth, in order to keep the cloth properly spread out at these parts. There are also formed cases by stitching in the parts of the clothing intended to cover the back and front of the body, as seen in Figures CXXVI., CXXIX., and others at 122, &c., in which thin springs are placed and secured by stitching to keep the clothing properly spread out as it lies on the body. These two portions of the outer layer of the cloth are formed at the edges like the corresponding front layer, and are also closed over the back standard by lacing. The manner of attaching the upper and middle, and the middle and lower pieces together, is by elastic web and buttons and button-holes, and as has been described and shewn, & as also indicated in Figures CXXVI. and CXXIX. and others. When the apparatus is not required to operate directly on the head or neck, the back and front standards terminate on the hard leather at 123, Figure CXVIII. and CXX., the elongations of the levers intended for the head and neck being omitted. In this arrangement the top buckles are fastened to the ends of the levers 123, 123, the ends of the levers being pierced with holes to allow of their being fixed by stitching. When the levers thus terminate, the back and front parts of the support being closed, present on the body the appearance shewn in Figures CXXVI. and CXXVIII. The straps and buckles which appear at 120, 120, in these and other Figures, are those which are fastened to the lower ends of the lower levers to keep them properly separated from each other. The upper levers of the back and front standard may be carried to the neck and head, and bent and formed so as to support these parts. Figure CXXIX. shews one as carried to the head, and the other to the neck; this being carried up at the front as well as at the back. The two shorter that go to the neck are connected together by a strap such as has been described, and buckles in the manner indicated in this Figure. In Figure CXXX. the two levers, one from the back and the other from the front standard, are seen as carried to the head, turned and placed on a portion of thin steel plate, padded ; on the steel plate is placed another portion of metal to form a tube in which the ends lie when the support with this arrangement for the head is in action. The plate is seen separately on a large scale in Figure CXXXI. where it is shewn as padded, and in section in Figure CXXXII., and having the ends of the head levers resting in the the tube. The ends of the levers may be inserted into or removed from the tube at pleasure, but are prevented from thrusting one another out or going too far by a shoulder formed in each, as seen in Figure CXXXI., and they may be kept in their places when necessary by ribbon or tape stitched to the pad, and tied over them, as shown in this Figure. The plate is padded with woollen cloth or other soft material where it comes in contact with the head. Figure CXXVII. shows both the anterior top levers of the front standard as carried to the head, for the purpose of preventing the head from dropping forward; the chin rests in a strap formed to fit it, and which is connected to studs or buckles affixed to the outer sides near the ends of the levers. The back levers can be carried up and connected with the front, and made to rest upon a plate, as described, and the lateral plates on which they rest can be connected behind to support the back of the head while the lateral parts of the neck and the back of the neck may be supported by straps and buckles connecting the lateral levers together, and also the back levers, as indicated in Figure CXXXIII. and CXXVII. or as it may be required. When the chest guard, Figure LXVII. above described, is used in connection with compound jointed standard steel plates, with holes to receive the studs 41, 41, may be rivitted on the upper part of the hard leather Figure CXX. at 124. This form of plate here shewn allows the chest guard to be placed around either shoulder, or both, if required. I can use other parts of my apparatus above described in connection with the compound jointed standard, as the latero-anterior levers extending to the base of the neck as before shewn, and which may be fixed in their places by buckles and straps; but in cases which require their use I prefer the several arrangements before described, and shewn in the Figures, as being more simple and easily managed by the surgeon. When the compound-jointed standards are used, and the support properly closed round the hips to prevent it from slipping, they are made to produce a powerful lifting action at the same time that they are made to operate on all the lateral unnatural projections through the medium of the soft material by which they are connected, in such a manner as tends to reduce the curves of the spine, and restore the deformed parts to their natural relative positions. The parts of the clothing are to be buckled so as to bear on the unnatural projections, while those portions which cover the hollow or flattened parts of the body are left comparatively loose, that no impediment may be offered by the support to the return of the spine to its natural line or the pelvis. The Diagram Figure CXXXVI. is illustrative of such actions. The straps and buckles 120, 120, and that represented at 125, enable the operator to regulate the action of the levers when in use, as the circumstances of the case may require. This form of lever is more applicable to recent cases than to those in which the deforming process have made much advancment. In some cases the chest is deformed anteriorly independant of and unconnected with spinal curvature. In such cases I have recourse to my chest corrector, Figure CVI., with my Patent stays, in which the back parts are closed by buckles and straps. I insert in the latero-posterior portions of the stays levers with buckles and straps similar to those described and illustrated in Figures XCV., but without the cross strap 76. These levers are encased between the layers of the stays by stitching, as indicated in Figure CXXXIV., where their situation and width is indicated by the stitching. When the stays are thus furnished, the chest corrector is placed and annanged between the stays and the body, and the stays are then closed upon it. The webbing straps affixed to the tops of the latero-posterior levers are then passed through the loops formed in or on the upper arms of the chest corrector returned upon themselves, and buckled, as seen in this Figure, and the arrangement of the front parts is seen in Figure CXXXV., where the situation of the chest corrector as marked by dotted lines. The strap attached to the middle of the lower edge of the chest corrector is then brought up over the lower end of the busk of the stays, and buckled, as seen in Figure CXXXV. The straps affixed to the lower arms of the chest corrector are carried through holes or long loops previously made in the stays turned round the latero-posterior levers 126 and buckled at the back, as shewn in Figure CXXXIV. The chest corrector being thus arranged, the operator can produce an influence on such projections in the anterior parts of the chest as require to be reduced. The straps must be so regulated that the bearing of the corrector on the unnatural projections of the chest may be very gentle, and so as only in a slight degree to impede the movement of the chest in inspiration. The action must be regulated from time to time as the state of the parts may require.

The operation of my apparatus for distortions, deformities, and local muscular weakness in the lower extremities, is shewn in Figures XVII., XXV., XXVII., XXVII., XXXI., XXXII., XXXVII., and XXXVIII. In Figures XVII. and XXV., the action is seen to be in the direction of the length of the limb, in which direction a gentle traction is produced when necessary between the foot and the hip, in order to facilitate the return of the distorted bones to their natural relative position, which is effected principally by the lateral actions of the apparatus. The same principles are carried out as shown in Figure XVII., XXVII., with the addition of a rotatory action, which is effected by the cross lever A, shown in Figure I., with its appropriated straps, which have been described. In Figures XVII. and XXV., the reduction of the distortion is effected by traction in the long axis of the limb, the support being made of sufficient length by shifting the joints to produce this effect when the boot is firmly laced, and the upper straps and buckles, Figure XII., are properly fastened, and the apparatus fixed in the straight position. The lateral effect is produced by drawing the projecting parts towards the bar or bars of the apparatus. In these cases part of the superincumbent weight is thrown upon the compound bar Figure I., of the apparatus. In Figure XXVII. the reduction of the distortion is effected by traction or extension, and counter-extension, more or less in the long axis of the limb, as in the last case, and by drawing the limb towards the bar, Figure I., at the lower part, and the bar toward the limb at the upper, so as to cause it to press upon the outer side of the limb at the knee and foot, and so compel the parts by a gradual process to assume the line which is natural to the limb. In the deformity, Figure XXXIII., the apparatus is seen in Figure XXXVII.

and XXXVIII. producing antagonizing actions upon the deformed bones, the upper parts of the bones being drawn forwards by the action of the apparatus, while the middle is drawn backwards. In these cases nearly the whole of the superincumbent weight of the body in walking or standing is thrown upon the bar Figure I. with a view to favor the restorative action of other parts of the apparatus. In Figure XXXI. and XXXII. a large portion of the superincumbent weight, sometimes nearly the whole of it, is thrown upon the bar, Figure I., which in these cases, as in those just mentioned, is carried to the hip and secured, as has been described and shown, while the bars at the lower part, aided by the straps, antagonize the actions of the stronger muscles, and sustain the foot at a proper angle upon the legs; or, when the muscles and front of the leg are weak, the foot is kept at a proper angle by the antagonizing action of the levers or bars assisted by the straps employed. In all these cases the bar, Figure I., is kept locked or fixed in the straight position by the catch when the person is walking or standing. If a combination of these several cases occur in the same limb, such parts of the apparatus as may be necessary must be employed together and modified so as to meet the circumstances of the case, and which the knowledge of the actions of the several parts will readily suggest to the operator.

The action of other parts of my apparatus upon the head and trunk may be gathered from what has been said, but they may be further illustrated by referring to the Diagram Figure CXXXVII., where the direction of the straps indicates the transverse and oblique lateral actions, the oblique actions upwards or downwards producing effects also at the same time more or less transverse. The several parts of the soft material having been buckled close over the projections of each side of the body are made to antagonize each other through the medium of the back and front standards, as indicated in this Figure. A lifting action is seen in Figure CXVI., a protecting action in all the Figures where the chest guard is employed, and in all those Figures where the lateral levers are employed for this purpose anterior and posterior actions are shewn when the chest corrector is employed as in Figure CVII., and where the braces are used, as in Figure CX., rotatory actions are shewn, as in Figure C; when my apparatus is used as many of the mechanical powers as are herein mentioned must be taken and combined so as to produce such actions, such protection, and such support as the condition of the parts in any given case may require, whether the affections be in the spine, chest, or limbs, or any or all of them, and whether the complaint be complicated with disease or otherwise. The apparatus employed should not be removed from the limbs or trunk, except for the purposes of ablution and changing the under clothing, except in some cases of paralysis. Their effect should be modified from time to time as the condition of the parts may require.

From what has been said it will be seen that my apparatus is applicable in various combinations of its parts to local deformities or weaknesses, as they occur in one limb only or one part of a limb, or in both limbs, and in different parts and varieties at the same time, and as I have shown or indicated, or appropriate combinations may be used for the relief or correction of deformities and weakness as they occur in the spine, chest, and limbs at the same time and as has been described. The apparatus must be made of a size and strength, and in such combinations of parts, as will be found adequate for the purposes intended. No more nor any less should be employed than is sufficient to meet the circumstances of the case for which they are constructed. With respect to the metal employed in the construction of my leg apparatus, it is proper to state that I use or cause to be used steel of spring temper, the bars varying in width from half an inch to one inch, and in thickness from one eighth to one quarter of an inch, the bars being somewhat curved where they are not required to touch each other; the full thickness named is made in their middle through their whole length. The degree of thickness and width varies with the size of the person for whom they are made and the purpose which they are intended to answer. The steel used in the formation of the standards, and the lateral levers used in my spine supports, varies in width from three quarters of an inch to an inch, and a half an inch being the common width employed for adult patients. The same width is used for the neck springs at their broadest part, and also for the narrowest parts of the shoulder springs, but the cross back and front levers or springs are not required to be more than half an inch wide, and the thickness in all these springs or levers is commonly about $\frac{3}{32}$ of an inch, or more or less as may be necessary; when the back standard is composed of two springs or levers, they are made half the width of one but of the same thickness as one. When the compound jointed standard is used the width of the several bars or levers may be made to vary also in width and thickness, according to the strength required; from one quarter of an inch to three eighths in width is convenient, except the levers intended to lie on the lower parts of the body, where they must be rather wider to give additional strength to these parts, and also to allow room for the formation of the long holes which are made in them. The thickness is a full eighth of an inch, and the length from two inches to two inches and a half, except the two upper or two lower levers or limbs, which require to be more varied in length according to the object of the surgeon or operator.

Having given a description of my apparatus, and shewn, with the assistance of the Drawings hereunto annexed, the manner in which the same are made, and pointed out several descriptions of cases in which the same or parts of the same are applicable, also the manner of using them in such cases. I think it right to mention that I do not intend it to be understood that the said apparatus above described or shown are of themselves commonly sufficient for the restoration of the several distorted or weakened parts of the body which have been named, but I hereby distinctly state, that the several apparatus or parts of apparatus are used with safety and success by competent persons duly qualified as medical men, able to regulate their actions, being properly conversant with the effects of such apparatus on the human body, when employed with due regard to its structure and to the functions of life, and to the several parts in a state of health or deformity or disease for the restoration of which the use of apparatus is required. It is also to be understood that due attention is to be given to the diet of the patient, and to the use of medicine, manipulations, and exercises, which should be specially directed for the particular purposes, as the same may arise, on the broad principles of medical, surgical, and mechanical science. I do not intend to convey that my apparatus will be found in all cases for which they are employed to supersede the necessity of surgical operations when employed for the relief or corrector of deformities in the limbs or in the trunk, though with few exceptions, especially in cases of deformity of the spine and chest, they will be found to do so under judicious management. But where the knife is required, the apparatus which I have invented comes in as a most important and safe auxiliary in the restoration of the affected parts, and will be found indeed the grand means to enable the surgeon to restore the parts which have become weakened, distorted, or deformed, to their natural strength, form, and situation in the body; means which with the several aids derivable from medical and surgical science, as the same may be necessary in particular cases, will not disappoint the fair expectations of the properly instructed and judicious professional attendant, or the fond hopes of those committed to his care. The great principle to be observed in the treatment of deformities is to restore the distorted parts to their natural situations and to keep them there, and also to restore the particular bones which have become deformed to their natural figure, without injury to the health or to parts of the body not involved in the complaint. The first of these principles may be answered in some recent cases by the hand, or simply by position; but as the hand cannot be kept in continual operation the distortion will return when the hand is removed, and as long continued confinement to the horizontal or inclined position is often found to be injurious to the health, it should rarely be advised. The surgeon must not depend on the unaided powers of the body alone for the restoration of deformity, except it may be in some very recent and slight cases, for if the powers of the body have become too weak to sustain the bones and joints in their proper relation to each other, it is not in general to be expected that they will be sufficiently strengthened to restore them when they have become distorted or deformed. This fact is proved by every day's experience; were it otherwise such cases would be rarely met with in adults, whereas experience proves them to be very common. Distortions and deformities can rarely be removed even in the early stages, by medicine, by diet, by friction, by change of air, by exercises, or by the combined operation of all these; otherwise, why is it so constantly found that where such means are resorted to, these cases get worse and worse, distressing the mind, disturbing the health, destroying the prospects, and often prematurely the bodies of the sufferers. While the surgeon does not despise or reject any of the means I have named, but avails himself of them as circumstances may require, he must consider, if he would treat deformities and weaknesses with satisfaction to himself and to those submitted to his care, that his principal agents must be mechanical, and that they must be regulated diligently by the laws of mechanics, as the same are applicable to apparatus applied to the human body. If we want to prop a bulging wall, which is a mechanical structure, we have recourse to mechanism for that purpose, full well knowing from experience that nothing else will answer the purpose. The human body is a most complicated machine, and if its framework gets out of place, or bulges here or there, mechanical appliances must be had recourse to to reduce the projections, and to aid in restoring the functions of the parts to their full operations. A bulging wall may be propped, and the forces employed may be even sufficiently powerful to restore it to its perpendicular again, but though such restoration might be effected, it never becomes firm from propping; take the props away and it will soon return to its former inclinations and ultimately tumble to the ground. Not so, however, with the human body, the framework of which may give way during periods of weakness or disease, and become incapable of reduction without adequate mechanical assistance; but when such assistance is furnished, and properly applied, and regulated with due regard to the functions and structure of every part, the distortions or deformities are gradually reduced, the bones are brought into their natural relative positions, and their forms are altered to their natural figure, and, except in cases of parylisis, they gradually acquire, under judicious management, their natural tone and firmness, and become capable, in a very large majority of cases, of sustaining the superincumbent weight of the body without yielding unnaturally when all adventitious aids are removed. In some cases, however, the natural figure cannot be restored, as where there has been a great loss of substance from long continued disease, or very great deformity of the particular bones from many years continuance of the deforming process, and in cases which have arisen from paralytic affections, but even in almost all these, which are to be considered incurable, great relief and comfort are derivable from a right application and management of properly constructed apparatus. It is not to be inferred that I consider my apparatus herein described as superseding all other apparatus used in the treatment of distortions, deformities, and weaknesses, but I regard them as superseding in utility and safety all others hitherto invented for the treatment of the several varieties of deformities, distortions, and weaknesses herein named or described. The apparatus may be varied in manner of construction to a very great extent; it must, therefore, be considered that my main object is to develope the principles upon which apparatus constructed for the treatment of distortions, deformities, or muscular weaknesses, as they occur in the spine, chest, and limbs, should be made, and to show modes of carrying out those principles in the formation of apparatus by which the desired effects may be produced. These principles I shall now proceed to shew and determine:— The great principle to be observed in the construction of all apparatus to be applied to the human body for the correction or relief of distortions, or local muscular weakness, as they, or either, or any, or all of them occur in the spine, chest, and limbs, or in either or any of these parts, is that which operates by antagonising forces, so that the unnatural protuberances to be reduced, or the parts to be supported, can be simultaneously acted upon in such directions as tend to restore the projecting or distorted parts to their natural positions, without the necessity of confining the person affected to the inclined or horizontal posture, and without interfering injuriously with the functions of life, while all external mechanical impediments calculated to hinder such restoration can be by such apparatus at the same time prevented or removed. Upon this principle the unnatural external projections arising from distortions or deformities are simultaneously made the fulcra of all the levers or other mechanical powers employed in their reduction and in the restoration of the affected parts to their natural relative position and figure. The antagonism as a whole is the apparatus employed employed versus the unnatural projections and inclinations, and in its parts versus particular unnatural projections and inclinations, and whether such distortions, deformities, or inclinations exist in the spine, chest, or limbs, or in any or all of these parts. The principle of antagonism, embracing also the principle of protection, as above described, I carry out by a series of supports and other apparatus adapted to the cases for which they are employed, as I have shown. The several apparatus, or parts of apparatus, consist of a series of levers in various numbers and in various forms, arranged in various lines and connected in various manners by metal or otherwise, as by screws, racks, rivets, pivots, springs, catches, buckles and straps, buttons and button holes, so as to form such manner of apparatus as may be required, some being made to protect certain parts from pressure, while others act upon other parts with any degree of force which in the judgment of the operator may be safe and proper, and in any direction in which the spine, chest, or limbs, or any or all of them, may be made the centre or centres of such actions. The operation of the mechanical powers employed can respectively be made more or less local, and more or less powerful, by the use of screws, wedges, racks, pads, springs, straps, and other auxiliaries variously placed, as the state of the parts may indicate. The forces employed by me are entirely under the power of the operator for protection and for action, as the circumstances of the case may require, tending continually, when judiciously managed, to restore the parts individually and collectively, and in no way hindering their restoration. It is manifest that no one combination of apparatus is suited to all the forms of distortion, deformity, or local muscular weakness that occur in the spine, chest, and limbs, or either of them. The apparatus must be suited to the case, but the principle of action and protection by antagonizing forces should be the same in all, when used for correction or relief of distortion, deformity, or local muscular weakness, as the same occur in the spine, chest, and limbs, or in any of their parts.

In the treatment of distortion of the spine and chest, and also distortions of other parts of the bony structure, whether arising from disease or otherwise, my apparatus worn upon the body are so constructed as to produce, at the pleasure of the operator, a simultaneous action at once partially and generally on all the unnatural projections requiring to be reduced, the unnatural projections being themselves the yielding fulcra on which the antagonizing forms employed are made simultaneously to operate directly or indirectly, and with various degrees of force, as may be necessary for their mutual reduction. The concave external surfaces arising from the unnatural projections or prominences are at the same time protected from external pressure, so as to leave room at those parts for the restoration of the body to its natural form under the influence of the means used, without the necessity of confinement to the inclined or horizontal posture, and without interfering injuriously with the natural functions of the body. The antagonism as above stated is effected by my apparatus in directions longitudinally, laterally, anteriorily, and posteriorly, transversely, obliquely, and rotatorily, or in all these directions at the same time, or in any number of them, and consecutively or simultaneously, as may be required, the great object of such actions being restoration of the natural figure, and the restoration and maintenance of the equilibrium of the body in the natural line.

I now proceed to declare,—

Firstly, that I disclaim the right to the exclusive use of any part or parts of the said apparatus separately, and which part or parts were previously known and in use for stiffness, weakness, or distortion in the human body.

Secondly, I disclaim the exclusive right to the use of any of the various parts of the said apparatus, however variously constructed, and which are herein described, and which were previously known and in use, except when I use the said part or parts in new and useful combination or combinations.

Thirdly, I disclaim the exclusive right to the use of any of the material or materials of which the various parts of the said apparatus are composed, excepting so far as the said material or materials are used by me in the combination of such part or parts of the said apparatus as are new in principle, or in new and useful combination or combinations.

Fourthly, I claim the various apparatus or parts of apparatus herein described, in new and useful combinations together, or in various new and useful combinations with other parts of the said apparatus; the mechanical powers employed being constructed and variously combined according to my principle or principles, which I have observed in the construction and combinations of my portable apparatus herein described, that is to say, upon the principle or principles of antagonizing actions, and of protection, so as to produce directly or indirectly the variously combined and modified influences or effects herein named, described, or indicated at once, on all the projections arising from distortion; and affording also at the same time protection from such external or other mechanical pressure to the several parts of the body as would hinder the restoration of the figure, and as the same combination or combinations may be suitable to the circumstance of each particular case, the apparatus being so constructed or combined upon the said principle or principles, are my apparatus. And such of the said apparatus or parts of apparatus as I am entitled to claim to use separately, I claim to use separately and exclusively, as well as in new and useful combination or combinations with other parts of the same apparatus.

Fifthly, I claim the exclusive right to the use of the old or known part or parts of the said apparatus, and of all appropriate materials, so far as the same are or may be used in constructing my apparatus in new and useful combination with the said newly-formed parts thereof herein described.

Sixthly, I do hereby declare that the apparatus, as the same are herein indicated, described, made, used, combined, and constructed, do, together, make up my improvements in apparatus for the relief or connection of stiffness, weakness, or distortion of the human body.

Having thus described the construction of the various apparatus, and the manner of their application in use, I now proceed to distinguish those parts which I claim as believing the same to be new; and with the exception of those parts which I do so claim, I expressly disclaim the other portions of the said apparatus, except when I use the same in new and useful combination, as before mentioned.

In the group of Figures from 1 to 38 inclusive, I claim the connection of the part A in Figures 1, 3, 4, with the part B shown in Figures 1, 3, 4, and other Figures; and this part A so connected in combination with other parts of the compound bar, Figures 1, 2, 3, 5, 6, 7, 8, and the parts shewn in Figures 9, 10. I claim also the strap, Figure 14, or other connecting medium for the same purpose, in combination with the part A, Figures 1, 3, 4, and in combination with other parts of the apparatus, shown in Figures 1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 15, and also as partly shown in connection in Figure 16, and as in use as herein described in Figures 17, 25, 27, 27, and indicated and herein described as used in Figures 31, 32, 37, 38. The use of the part A is to enable the surgeon to operate on the limb in cases of in-knee, Figure 11, so as to keep the feet in their right position in respect to other parts of the limb and body, which is done by the action of the strap, Figure 14, used as has been shown. The joint *l*, as described, by which the parts A and B are connected, facilitates the movements of the trunk upon the limbs, and the limbs upon the trunk, when the apparatus shewn in Figure 16 is used, as seen in Figure 17, and shown or indicated also in other Figures. When the part A is used with the straps, Figure 14, in the cases shewn in Figure 26, they aid also in drawing the compound bar Figure 1 close to the upper part of the limb, as may be required. When only one limb of the person is effected, this is done by the operation of the strap, Figure 14, on the hips, but when both limbs are so deformed, and the compound bar is fitted up and used, as has been described, the parts A antagonize each other, but they are made to approximate by the straps operating on the parts A, and through them the upper end of the bar on each side is drawn toward the upper parts of the limb. In this case the feet and ankles being kept in their right position by the apparatus, the fulcra are placed at the foot, ankle, and knee, and in the case Figure 26 A, also at the legs, the compound bar being made to operate on all these parts by the other portions of the apparatus employed, as shewn in Figures 27, 27. I am aware that apparatus with shifting and hinge joints have been used before for the removal of distortions of the knee and ankle, and that the same are often carried up to the hips, and by a portion of steel placed transversely to the top of the leg and thigh parts, the same are confined to the hips, but in these leg apparatus in use there are no special stops in the hinge joints intended to be placed nearest to the hip and knee and ankle, and therefore nothing to prevent the lateral movement of the parts above and below the joints, and consequently no provision to enable the surgeon to cause part of the weight of the body above the limb to be borne or suspended by the apparatus when the wearer is standing or walking; nor is there any provision in them to enable the surgeon to produce gentle traction on the limb, by which the restoration of the bones to their right position and form is often greatly facilitated. I disclaim all such apparatus. The compound bar, Figure 1, was invented by me, as shown in Figure 2, and has been long used by me in my practice, but without the part A and the strap Figure 14. In this bar there is commonly no hinge joint formed at the ankle, the movement of the screw *x*, in the screwed hole Figure 9, superseding the utility of such joint, and at the knee part the hinge joint is furnished with a moveable stop, by which the parts of the bar above and below this joint are made to have at pleasure the effect of an inflexible lever without joints, on which any part, or the whole of the weight of the body may be thrown when the bar is fitted up and used, as has been herein described. I do not claim, therefore, under this Patent, the said bar, as so made and formerly used by myself, but I do claim this compound bar as formerly made in combination with the additional part A jointed to it, as described, and the soft material in the form of straps or otherwise, by which it is connected with its corresponding parts, or affixed to the apparatus on the opposite side, or by which it is connected to the hips, as herein indicated and described in the Drawings. The principles carried out by this bar, and the appendages herein described, as formerly used with it, in combination with my improvements or additions, that is to say, the part A, and its appropriate connections, are, first, gentle traction in the long axis of the bar, rotation of the limb, and especially of the foot, and lateral antagonism between itself and the hips of the patient, or between itself and the corresponding parts placed on the opposite side, and between itself and the unnatural projections of the limb, and suspension by which part of the weight above may be thrown upon it, and so taken off from the limb, which is not in a condition to bear it without yielding or binding the restorative process. It is manifest that the same effects may be produced by an inflexible bar without shifting or hinge joints or both. And I claim such a bar in connection with my improvements, as above mentioned, but the shifting joints are for the purpose of facilitating the adaptation of the apparatus to suit the condition and alteration of the parts, and the hinge joints with stops are to facilitate the movements of the patient, as the same may be allowed by the surgeon. I prefer therefore, the compound bar Figure 1, and as above shewn in other Figures, believing the same to be more manageable, more comfortable in use, and equally efficient with one in which any or all the joints are omitted. The parts which I have above clained singly, or in combination, I also claim in combination, as the same may be required with the parts herein described, and also shown or indicated in Figures 18, 19, 20, 21, 22, 23, 24, 28, 29, 30, 34, 35, 36, and indicated as applied, as herein described, in Figures 25, 31, 32, 37, 38. The use of the apparatus Figure 1, fitted up with soft material in the form of straps having buckles affixed to them, or other means of connection, in combination with other parts of the apparatus, as indicated in Figure 25, are the same as have been mentioned, but with the addition of the jointed lever, Figure 20, fitted up with the plate, Figure 21, as in Figure 24, the lateral protrusion of the ankle, seen in Figure 25, may be corrected, these being formed between the projecting parts and the lever placed on the inner side of the limb, as shewn in Figure 25, antagonizing actions through the medium of the material or materials placed on the outer side of the ankle joint, and connected over the lever, so as to enable the operator to cause the ankle joint to approximate to it as the circumstances of the parts will allow; such approximation of the ankle joint toward the lever can be facilitated by the other parts of the apparatus. The apparatus, Figure 16, with the parts, Figures 28, 29, 30, fitted up with appropriate soft material, and having a screwed hole made on the part Figure 29, form a combination to be used in certain cases complicated with muscular weakness, from which the several advantages derivable from the combinations already claimed may be obtained, so far as the same are required for relief or correction of the distortions shewn, as indicated in Figures 11, 26, 26 A, with the additional antagonizing actions between different parts of the apparatus and other parts, and between the apparatus and the limb, whereby the weak parts may be aided, supported, and protected, and the distorted parts reduced to their proper relative positions, the surgeon taking care to fit up the apparatus in its different parts, and, as a whole, regulate the same as the circumstances and condition of the limb or limbs may require. If necessary, two stops, allowing a limited motion, can be formed at the hinge joint, Figures 28, 30, the part 8 being elongated, as may be necessary. This arrangement I also claim, in combination with the part Figure 16, as fitted up as may be required. If the distortion be still further complicated with deformity or distortion of parts of particular bones, the parts Figures 35, 36, are used with either of the levers Figures 18, 20, 30, fitted up as described, and also as shewn and indicated in Figure 34, as may be required. When the parts Figures 35, 36, are employed, as for the complication exhibited in Figure 33, as indicated in Figures 37, 38, antagonizing actions are produced by different parts of the apparatus upon the limb, and as between the limb and the apparatus, as indicated or illustrated by Figures 37, 38, and other Figures. If either of the levers, Figures 18, 20, 30, be carried up along the inside of the thigh to aid in the correction of bent thigh bone, an arrangement similar to that shewn in application in Figures 37, 38, will also operate on the thigh bone in connection with other parts of the apparatus in a manner the same as the arrangement shown in these Figures operates on the bones of the leg. Besides the principles of extention and counter-extention, suspension, support, protection, and lateral actions produced by the apparatus already described, singly or in combination, there is also superadded in this case anterio posterior and posterio anterior antagonizing actions, by the use of the parts, Figures 35, 36, employed as have been described and indicated. The several combinations of apparatus, by which these principles are carried out under the various and varying circumstances of distortion and muscular and other weaknesses, as they occur in the lower extremities, are my apparatus. In the correction of distortions of the spine and chest arising from disease or weakness, various combinations of apparatus are required to suit the various conditions of the parts as they are found to exist in these cases. The actions of the several parts of the apparatus must be under the control of the surgeon, so as to enable him to answer the several indications which are observed, so far as the same can be answered by any apparatus worn upon the body. In the management of these cases, I claim the exclusive right to the application and use of anterior lateral levers, and posterior lateral levers, and either used for protection and for action, or for action only, as may be required. I also claim the exclusive right to the use of those herein described, and shewn in Figures 94, 95, 96, 99, with the privilege to modify their form, width, and thickness, in combination with any or all the other parts of the apparatus herein described, and also shewn in the Drawings, as the said levers are or can be employed to aid in the correction or relief of spinal distortion, or weakness, or distortion of the chest, or both or all of them.

I also claim the several combinations of the said anterior and posterior lateral levers, with other parts of the apparatus herein described or indicated, and as exhibited, as the same can be severally used in the groups of Figures from 97 to 135 inclusive.

I also claim the part 69, Figure 92, in combination with the part 77, and as used with my anterior and posterior lateral levers, or either of them, as herein shown, and as seen as employed in Figure 104 and others herein described, and whether the same be made by an elongation of the lateral levers extending above the part Figure 77, whereby the same effect in some cases can be produced or as herein described.

I also claim the materials by which the anterior and posterior levers are made to act on each other, or by which the posterior lateral lever or levers are made to act on the parts made to bear on the front standard, and on the fore part of the shoulder or shoulders, as shown in the Figures, where these parts are shown as in use; also all the connecting materials by which the said anterior and posterior lateral levers or springs are connected with other parts of the apparatus herein described, or by which they can be connected to other apparatus.

I also claim the chest corrector, Figure 106, and whether made out of one or several pieces of appropriate material, and as the same can be applied in combination for distortions of the chest; also in combination with any part or parts of the apparatus herein described, and also indicated in Figures 107, 108, and with stays and posterior lateral levers, as indicated in Figures 134, 135.

I also claim the manner of connecting the parts, Figures 85, 70, so as to keep the part 85 from turning on its axis, when in use under the action of other parts of the support, and as shown in Figure 91.

I also claim the chest guard, Figure 111, used as a head support and chest guard with two levers in the back standard, as described herein, and indicated in Figure 112.

I also claim the chest guard in combination with head apparatus, as indicated in Figure 116, as the same may be required, and with the head apparatus, Figure 115, when employed instead of that shown in application in Figure 116, and as indicated in Figure 117.

I also claim the compound jointed standard, Figure 118, in its various modifications, so far as the same are applicable as means of relief or correction of spinal distortion or muscular weakness; also the several combinations of apparatus with the said compound jointed standard herein indicated, described or shewn or indicated in the group of Figures from 118 to 138.

I am aware that various forms of apparatus are in use for the correction or relief of spinal distortions and weaknesses of the parts connected with the spinal bones, and in some of them the apparatus is extended to the head. The principle intended to be carried out by such apparatus is to make the hips the basis of the support intended to be given to the spine, and therefore the various forms of apparatus in use are constructed so as to receive a part of the weight above, and convey it to the hips. Such spinal supports are constructed with metallic springs, made to embrace the hips, and metallic crutches are introduced into the lateral parts, extending from the framework round the hips to the armpits. Lateral plates of steel are sometimes connected with the lateral crutches with a view to prevent the increase of the lateral projections of the chest arising from the distortion of the spine. These several parts are more or less encased in soft material, and when combined together are confined to the body by lacing, and are called spine supports, spine correctors, &c.

In one form of spine support there is, in addition to the parts named as in common use, a standard connected to the framework adapted to the hips, and carried up to receive part of the weight of the head through the medium of connecting apparatus, and convey the same to the hips. In another description of spinal apparatus the hips are made the fulcrum of a lever connected with the parts, firmly enclosing them. This lever is extended up the back, and made to operate on the convex side of the principal lateral projection of the chest arising from distortion of the spine. In another kind of spinal apparatus, in addition to the lateral crutches before named, there is introduced in a direction transversely to the body springs intended to prevent the increase of the principal lateral projection of the chest, and to protect the flattened parts behind. The metallic parts of this apparatus are enclosed in leather, cotton, or linen material, and applied to the body by lacing. I disclaim all such combinations, the principle of which is to make the hips the basis or fulcrum of the support which they are intended to afford to the spine and other parts above the hips.

Another form of spinal support is that which I have invented and have long used for the relief or correction of spinal distortion and muscular weakness, the principal parts of which are shown as applied in Figures 49, 50, and which is fully described in my Specification appertaining to my Patent, bearing date at Westminster, the Fourth day of April, 1837.

The principle of this combination is not to take the weight of the body above the hips from the particular spinal bones, and carry it to the hips by the apparatus, but to bring the spinal bones into their natural lines with each other, and cause them to bear individually their natural portion of the weight in proportion as they approach the natural line. In accomplishing this purpose the apparatus is made to perform antagonizing actions between different parts of itself and different parts of the body in a manner agreeable to the object to be accomplished. It is made to operate upon all the lateral projections arising from spinal curvature, whether the projections be in the spine only or also in the chest and hips. The actions are principally lateral, though in different directions, so as to produce in some parts oblique depressing actions, and in others oblique suspending actions, antagonizing each other, transverse actions in the same parts of the opposite sides, and in different parts of the opposite side of the body. All the actions of this combination are towards the anterior and posterior standards. The direction of the actions is regulated by the extent and character of the lateral projections of the body on which they are made to operate, and their intensity according to the resistance which they have to overcome. The operation of the apparatus as a whole is on all the unnatural protruberances projecting laterally, the same being the fulcra, the extent of which the apparatus by its determined influence under proper regulation tends continually to reduce. The lines of influence from the sides to the centre of the body are as various as the form and extent of the lateral protruberances which the apparatus is intended to correct. This, however, is not the apparatus or spine support which I now specify; but I claim the several combinations formed by this apparatus with my newly invented parts.

In these improved combinations or Inventions all the lateral actions of my former Invention are preserved, the unnaturally hollowed and flattened parts are protected from pressure, all hurtful influence on the organization, and on the vital functions of the body, are removed. The anterior and posterior projections of the sides of the chest, which could not be sufficiently controuled by any apparatus in use, whether they arise from tortion of the spine or otherwise, are by the new combinations herein described brought under the action of new and additional mechanical forces which are made to operate directly and powerfully upon them in various combinations, and in such directions and with degrees of intensity equal to the requirements of the particular case, or as far as the parts operated on will bear without injury. By the several new combinations herein described or indicated, forming together my spine supports now specified, every variety of action which I have herein named can be effected upon the external surface of the distorted parts in such directions, in such manner, and with such force as in the judgment of the surgeon may be safely induced for the reduction of the unnatural projections, and the restoration of the natural figure, while the actions can be varied so as to afford support simply to the parts in particular, or to the whole of the trunk and head, as may be necessary when all distortion is removed. Nearly if not all the action of the ordinary spine supports centre in the hips; in my Invention they centre also in various parts of the body above the hips. In the common supports there is but one common centre of action; in my Inventions there are many centres of action. By the common supports all cases of distortion of the spine are treated upon one principle, namely, making the hips the fulcrum or basis of all the levers employed. In mine the fulcra of the several mechanical powers employed are the unnatural projections of the body, and consequently the fulcra of the support upon the body are co-extensive with the projections to be reduced. By the common apparatus the action is much the same, and very similar in all cases, allowing of little variation or modification. By my Inventions they can be easily varied to suit the particular and varying condition of the parts as a whole, or in various relations, and their influence can always be so regulated as to be positive and determined. The results observed under the use of the ordinary supports are uncertain and commonly unfavorable; by mine the actions are demonstrably sure in mechanical effect, and the results are most satisfactory.

My principle or combination of principles is to make the unnatural projections arising from distortion of the spine, chest, and other parts the fulcra of the several mechanical combinations employed for their reduction, so that every bone of the spine and other parts involved in the distortions herein named can be made gradually to bear, as may be required, its proper share of the weight above, so far as the same may be expedient, while all external mechanical impediments to the restoration of the natural figure are removed by the apparatus.

I claim also the several combinations so acting and so protecting as herein named as my apparatus.

I claim the application and exclusive use of my spinal apparatus, in combination with my apparatus for distortions and weaknesses of the limbs, as herein mentioned and described.

In witness whereof, I, the said Joseph Amesbury, have hereunto set my hand and seal, this Sixth day of November, in the year of our Lord One thousand eight hundred and forty-five.

JOSEPH (L.S.) AMESBURY.

DOWDESWELL.

AND BE IT REMEMBERED, that on the Sixth day of November, in the year of our Lord 1845, the aforesaid Joseph Amesbury came before our said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Enrolled the Sixth day of November, in the year of our Lord One thousand eight hundred and forty-five.

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1857.

A.D. 1845. May 6. No 10,659.
AMESBURY'S SPECIFICATION.

FIG. 1.

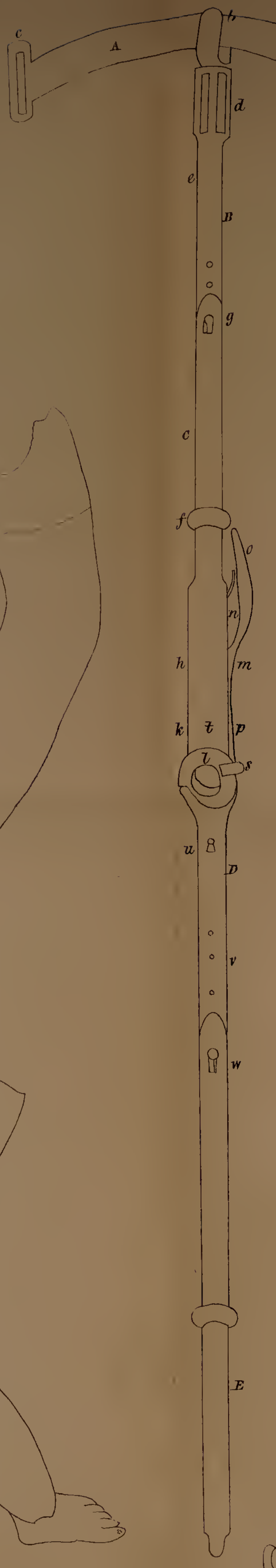

FIG. 2.

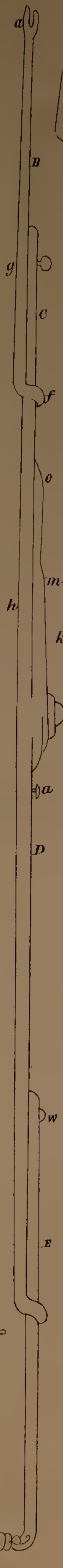

FIG. 4.

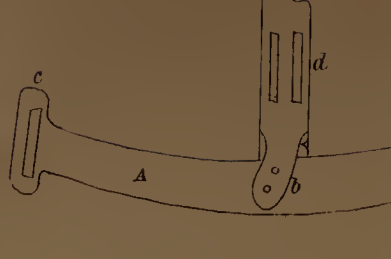

FIG. 3.

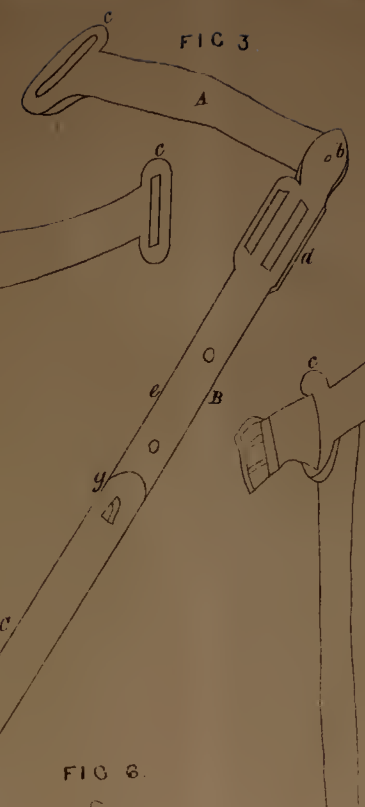

FIG. 6.

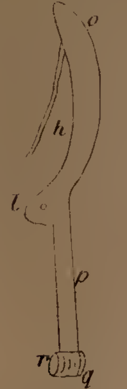

FIG. 5.

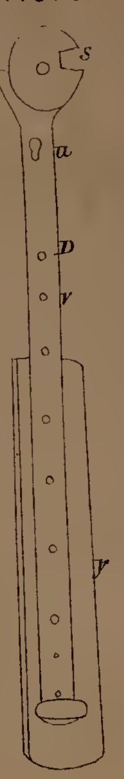

FIG. 7.

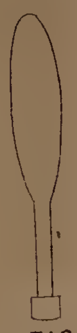

FIG. 8.

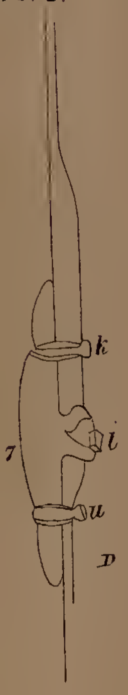

FIG. 15.

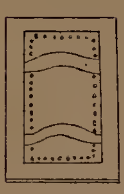

FIG. 10.

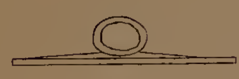

FIG. 9.

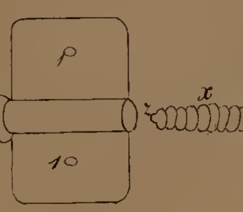

FIG. 16.

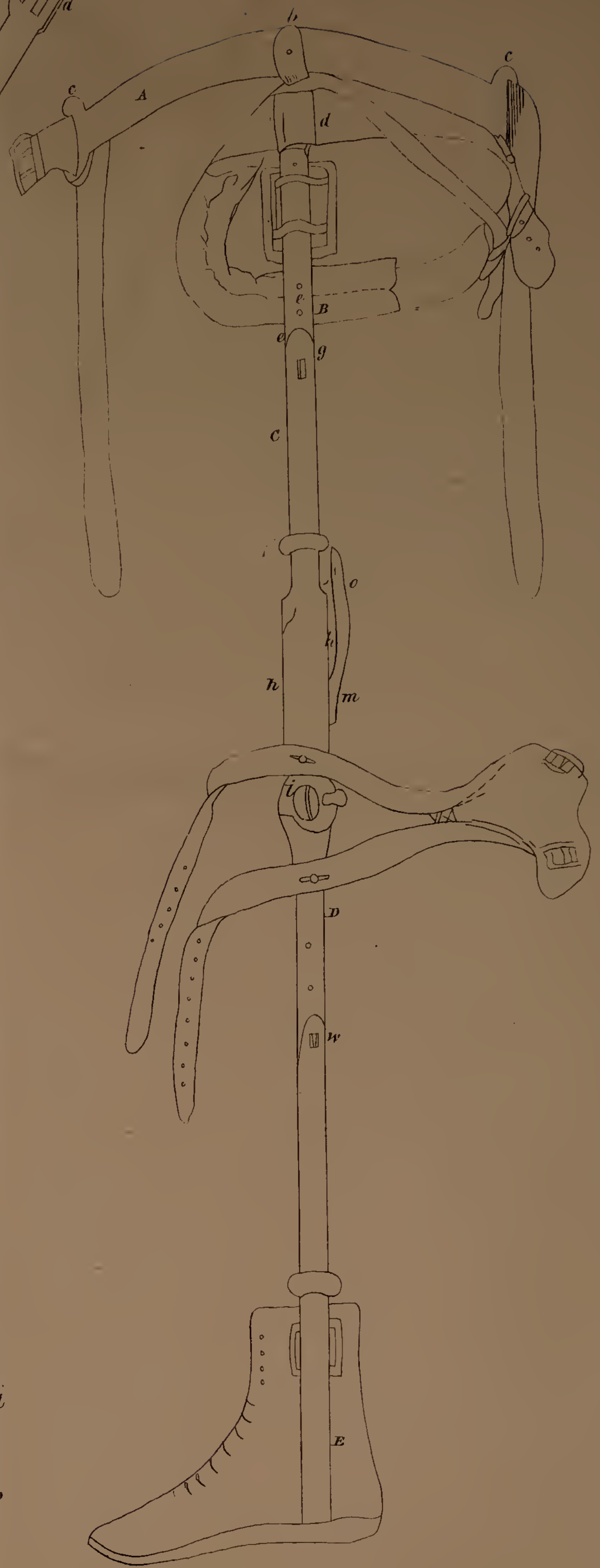

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FIG. 33.

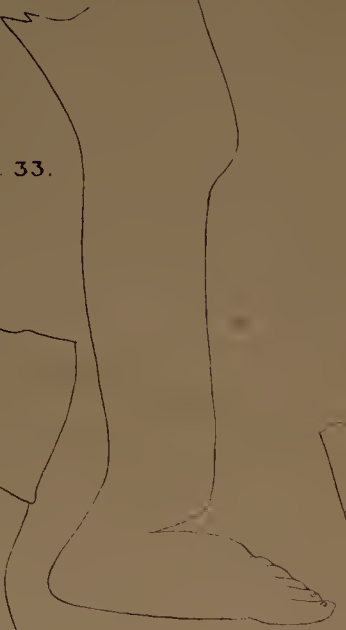


FIG. 26.

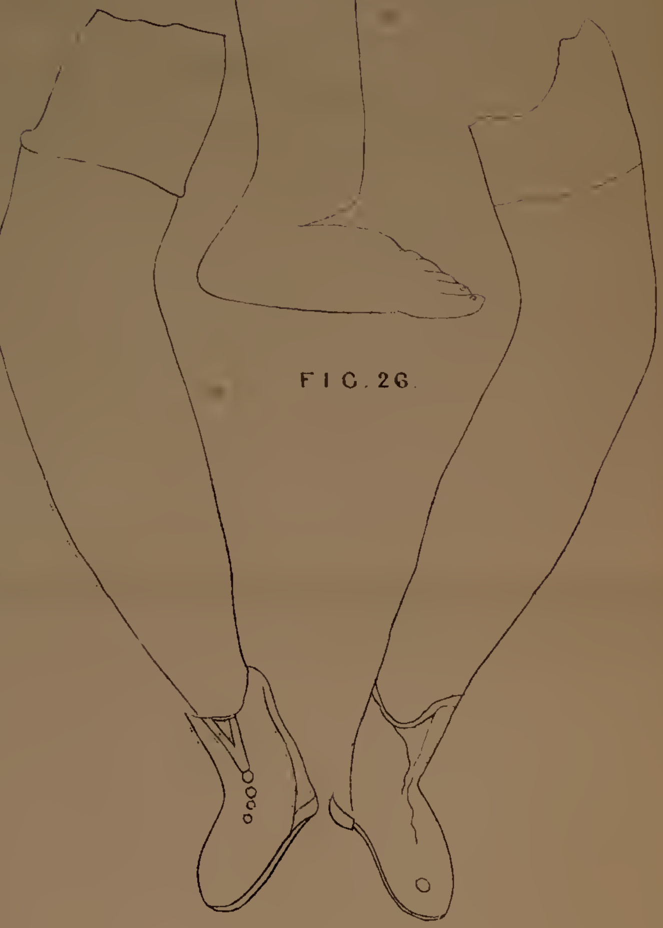


FIG. 11.

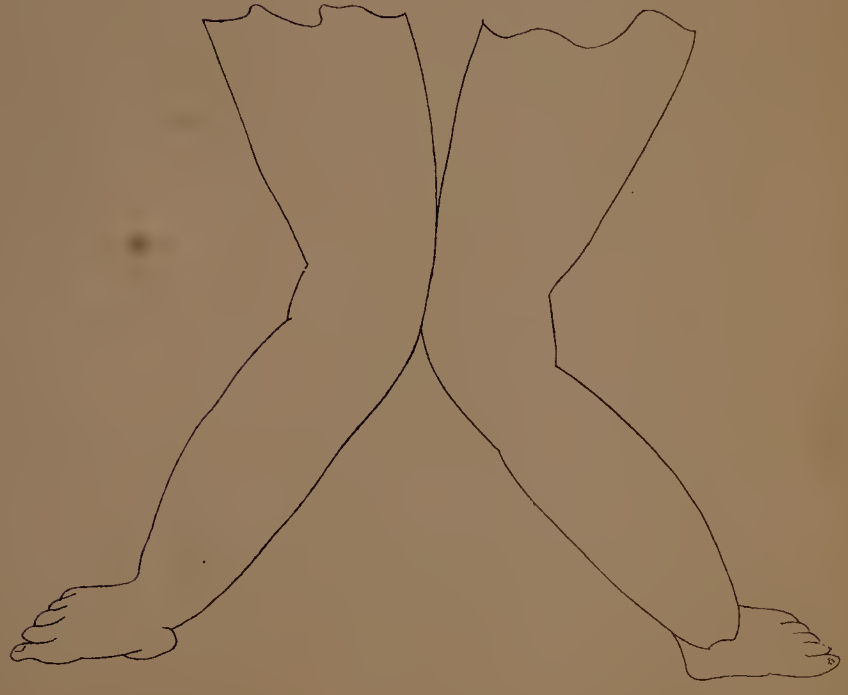


FIG. 26 A.

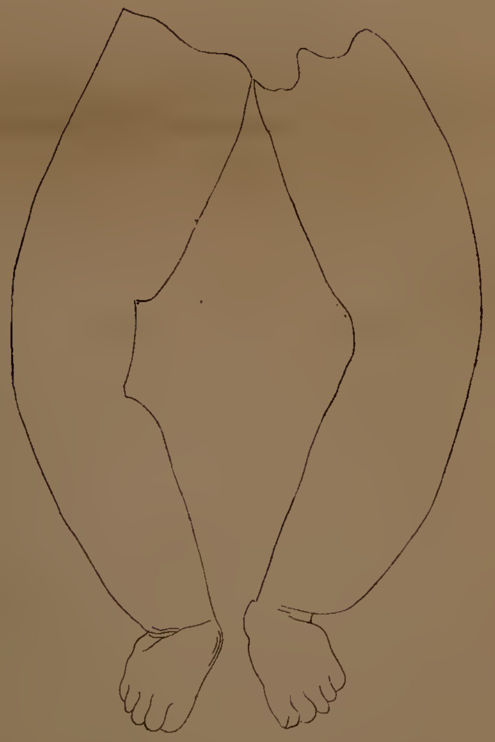


FIG. 12.

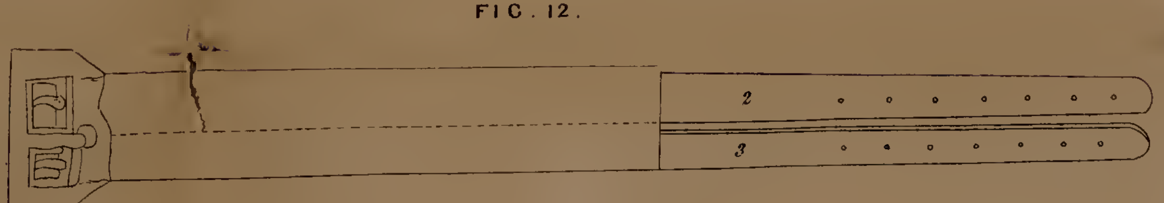


FIG. 14.

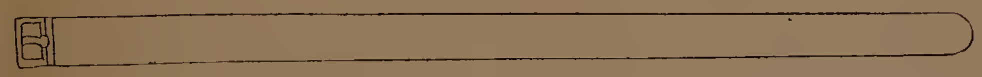
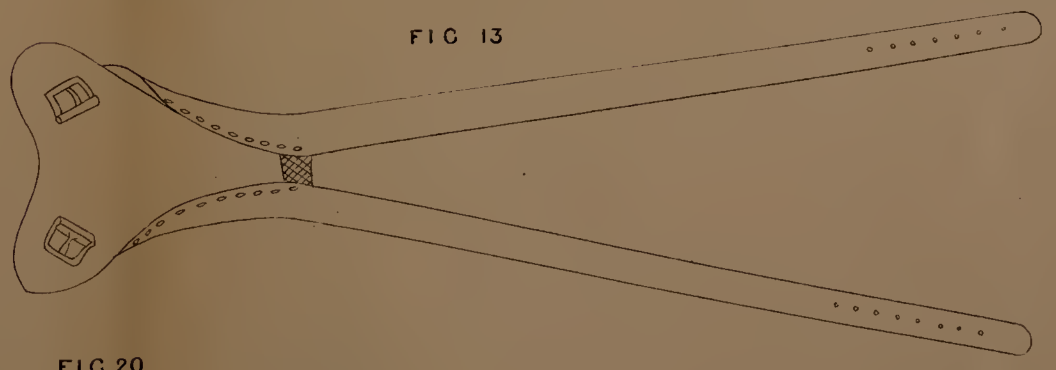


FIG. 13.



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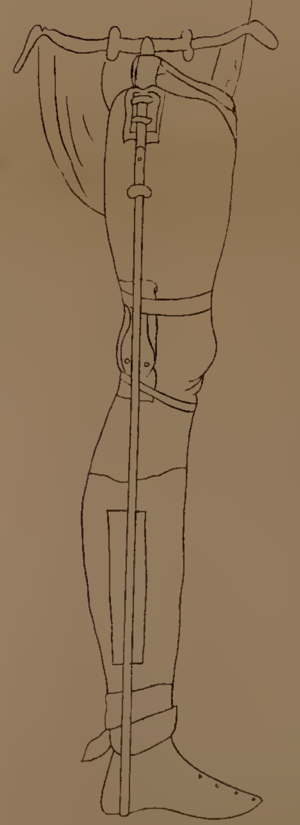

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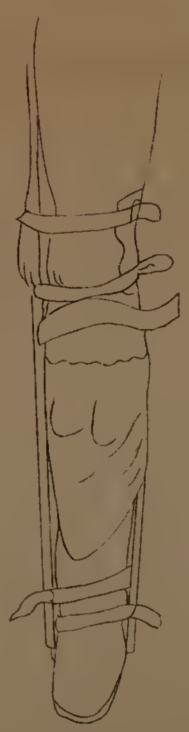


FIG. 31

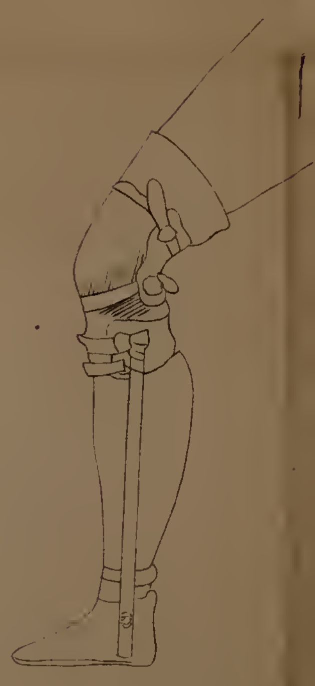


FIG. 18.

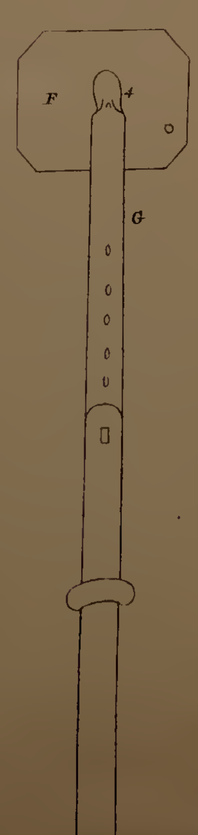


FIG. 19.

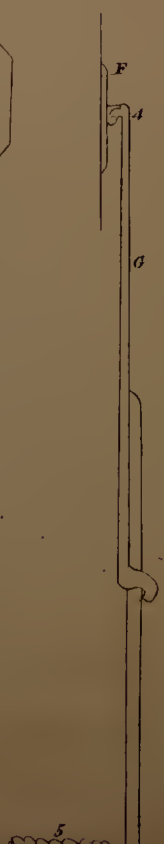


FIG. 20.

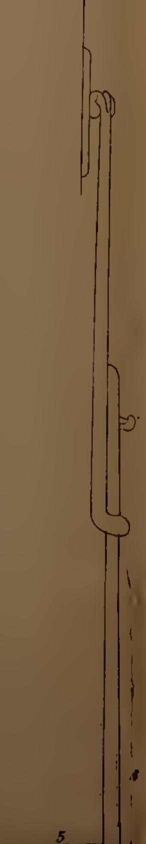


FIG. 24.

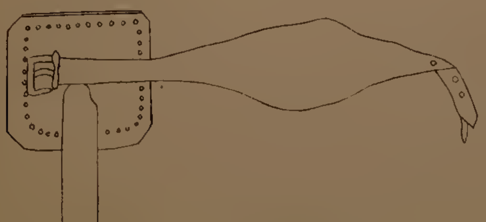


FIG. 22.

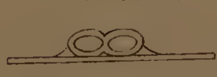


FIG. 21.

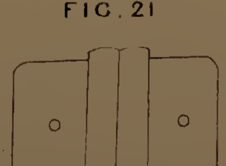
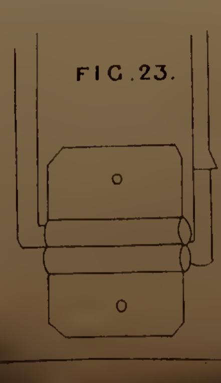


FIG. 23.



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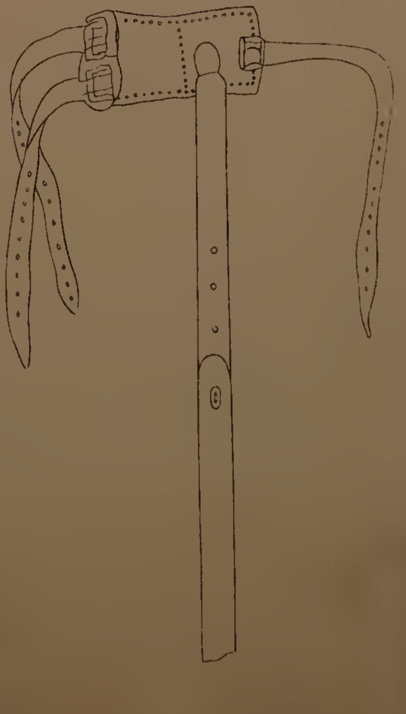

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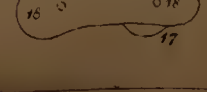

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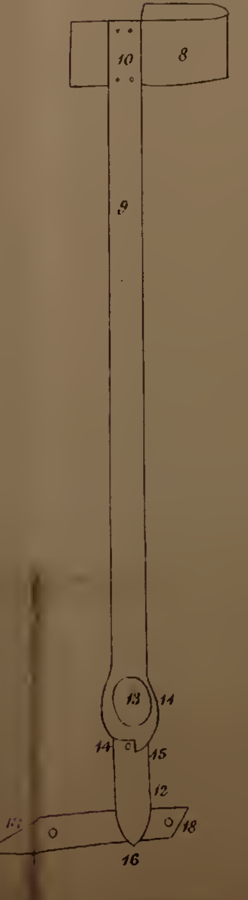


FIG. 30.

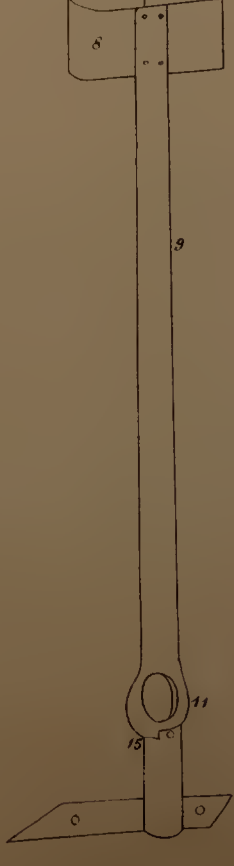


FIG 36

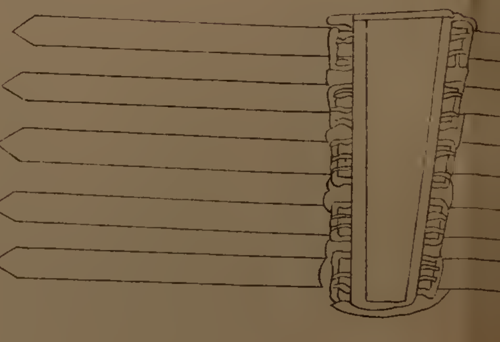
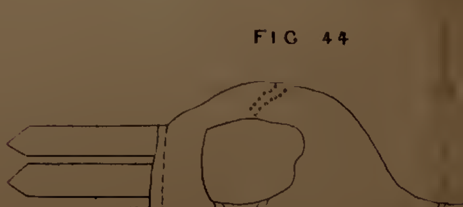


FIG 35

FIG 44



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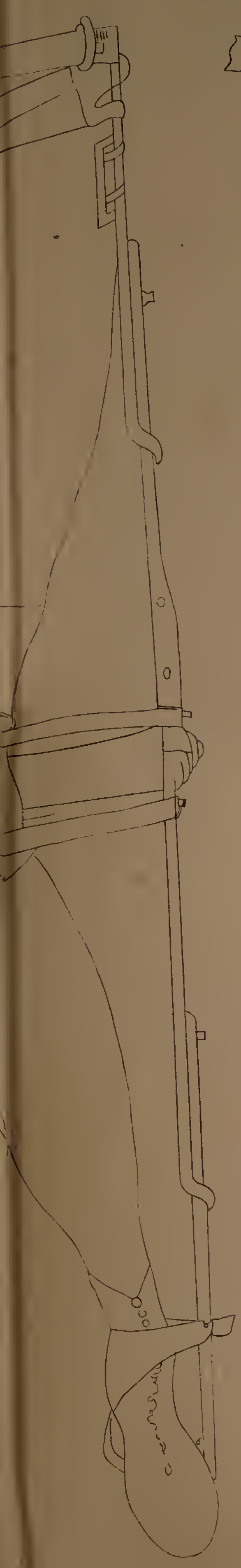


FIG 25

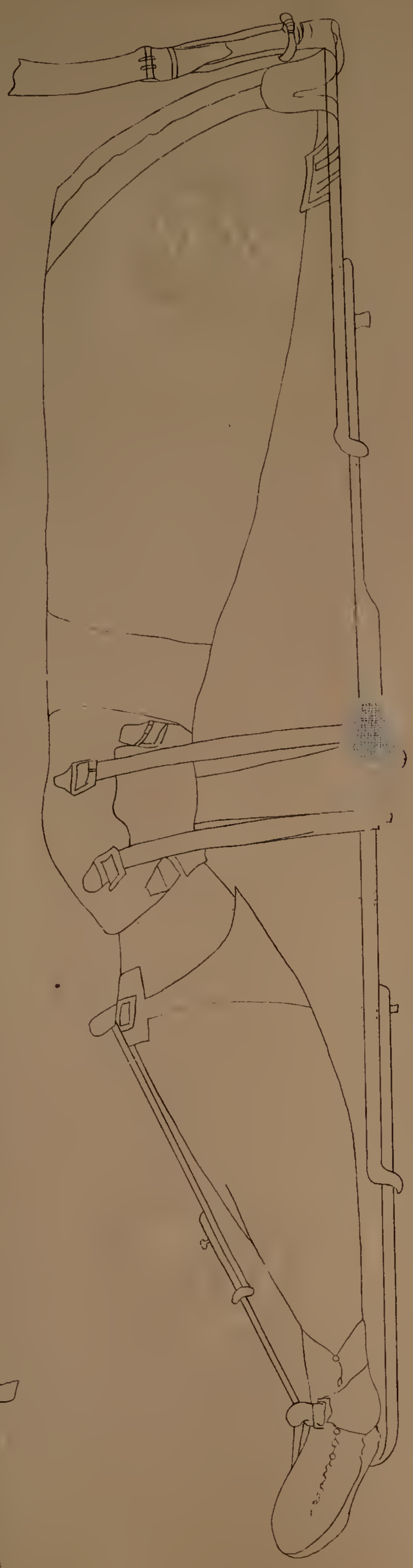


FIG 42

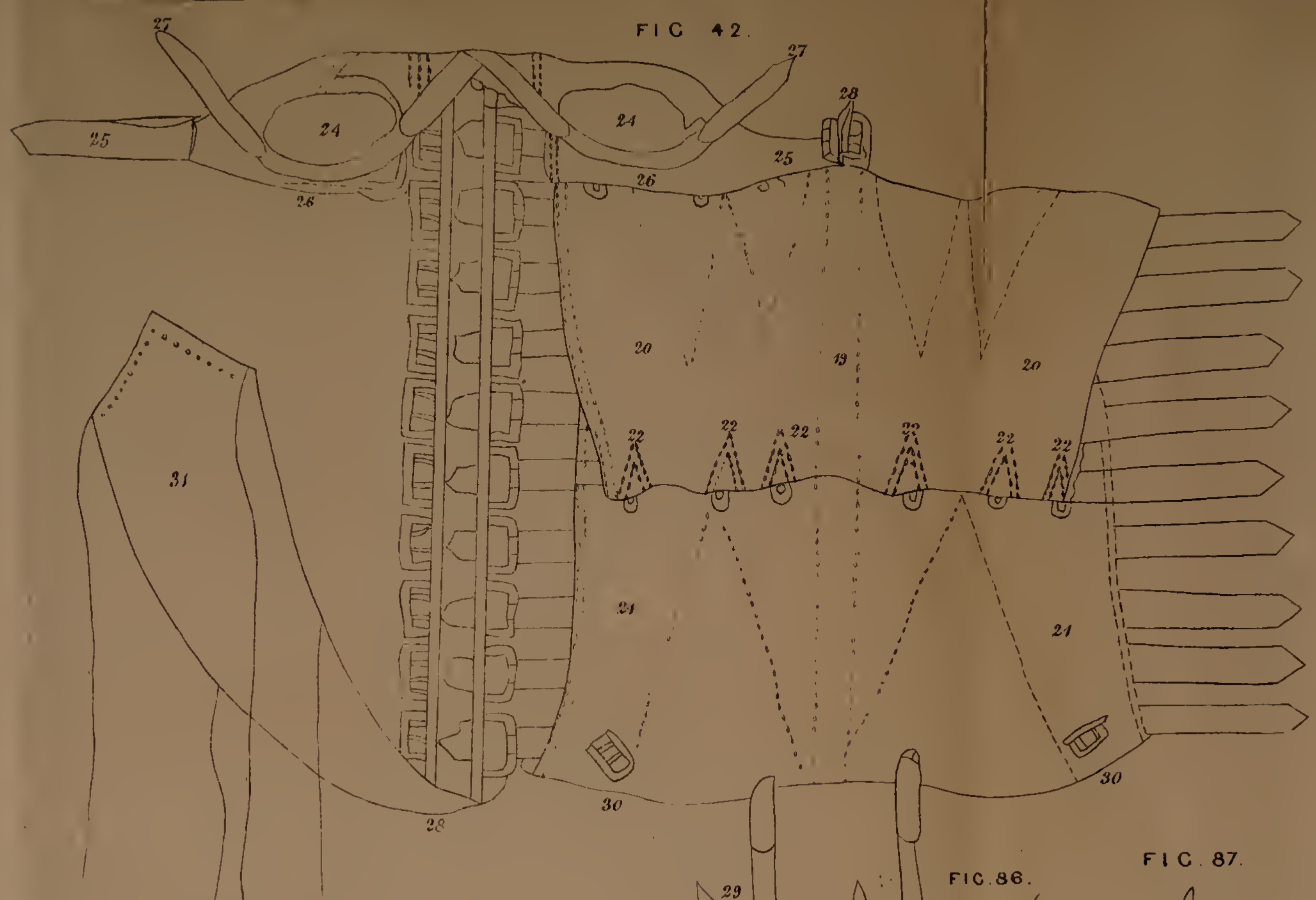


FIG 43

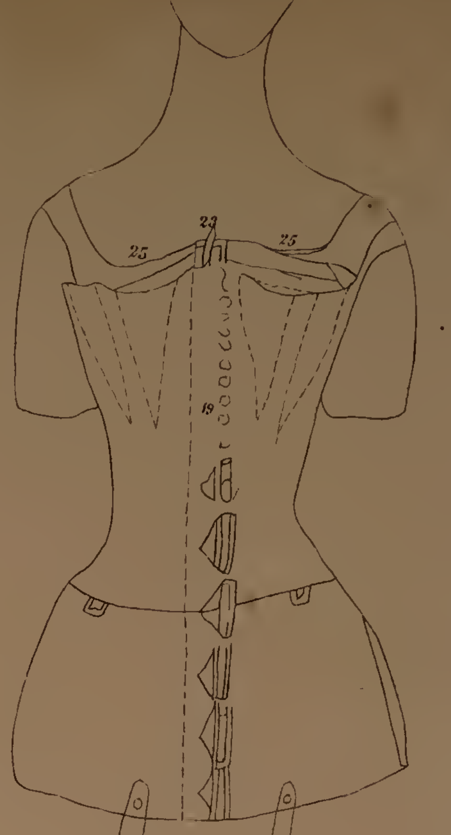
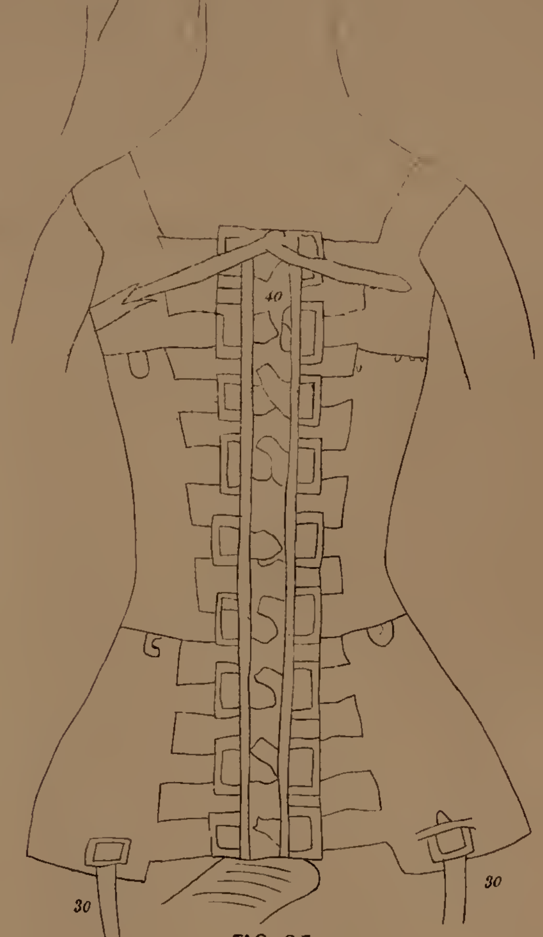


FIG 50



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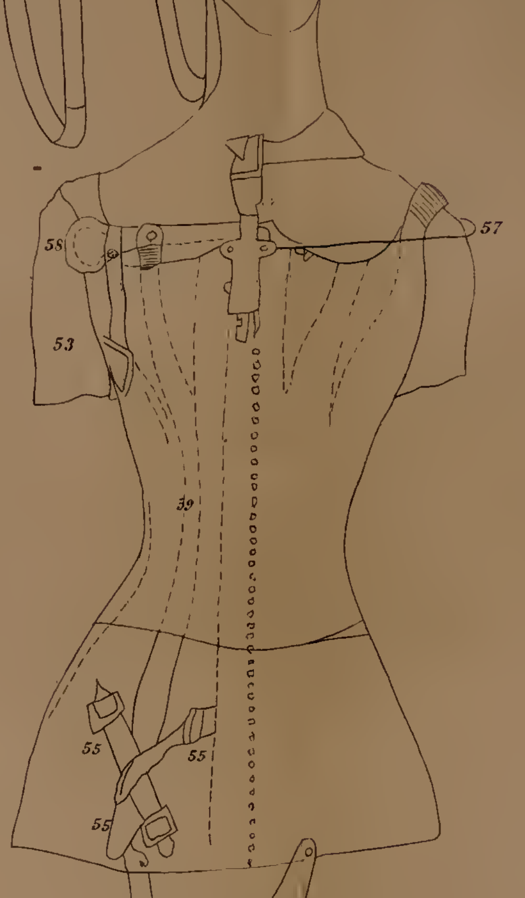


FIG 87.

FIG 88

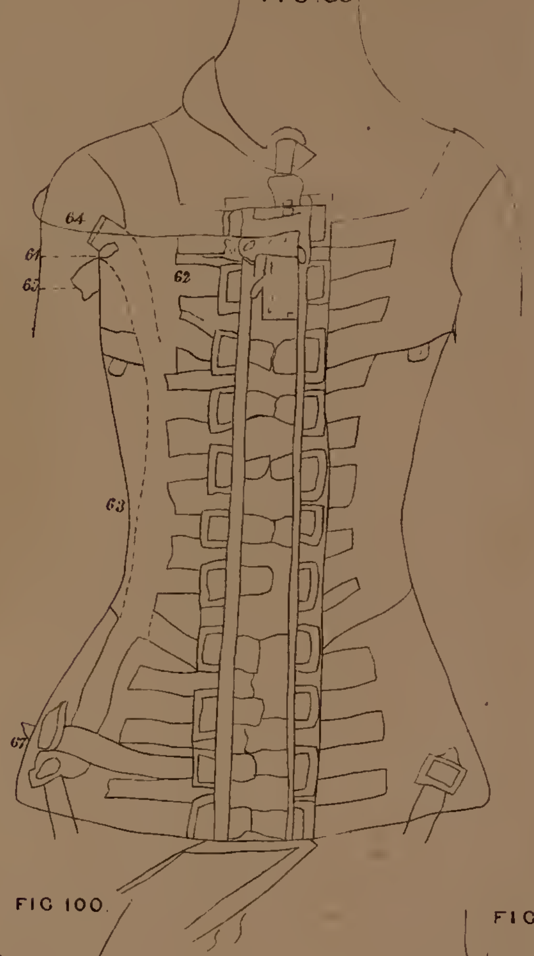


FIG 97

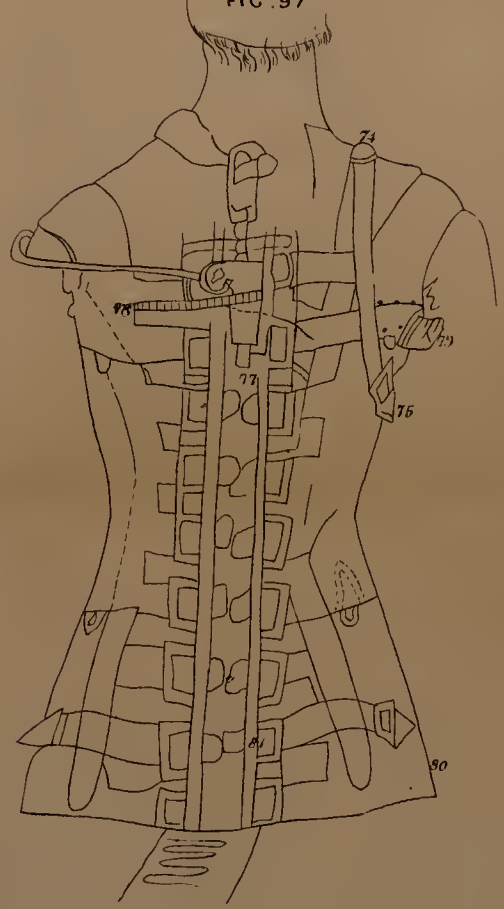


FIG 98

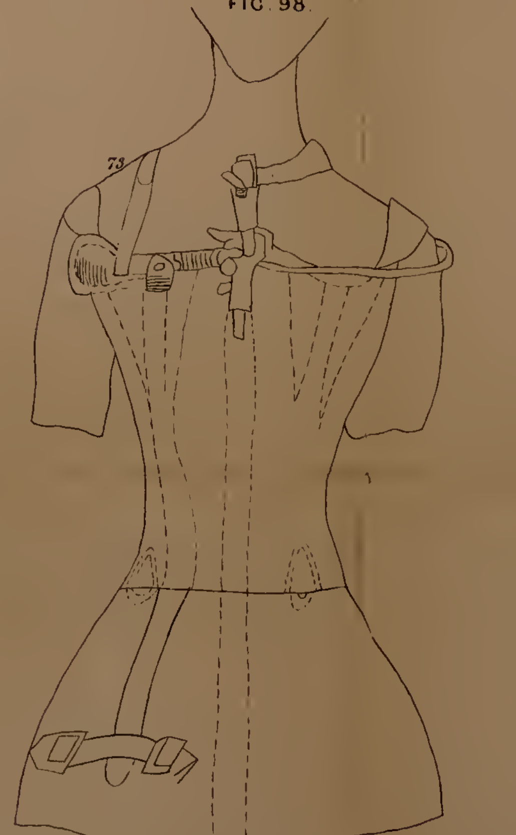


FIG 100

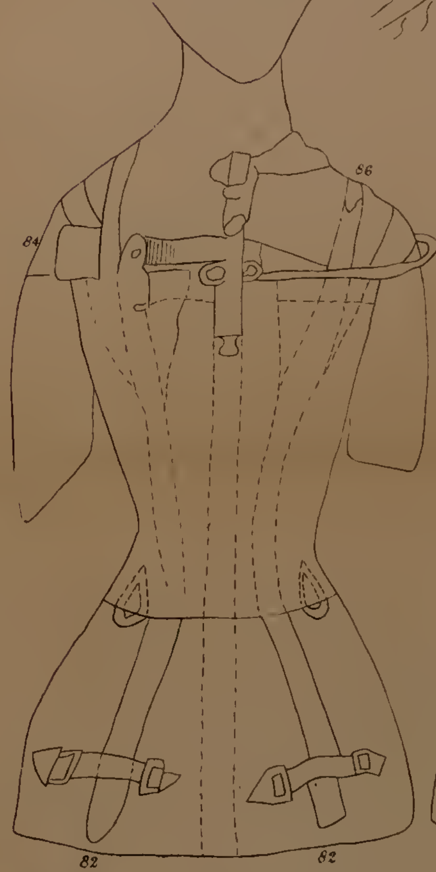
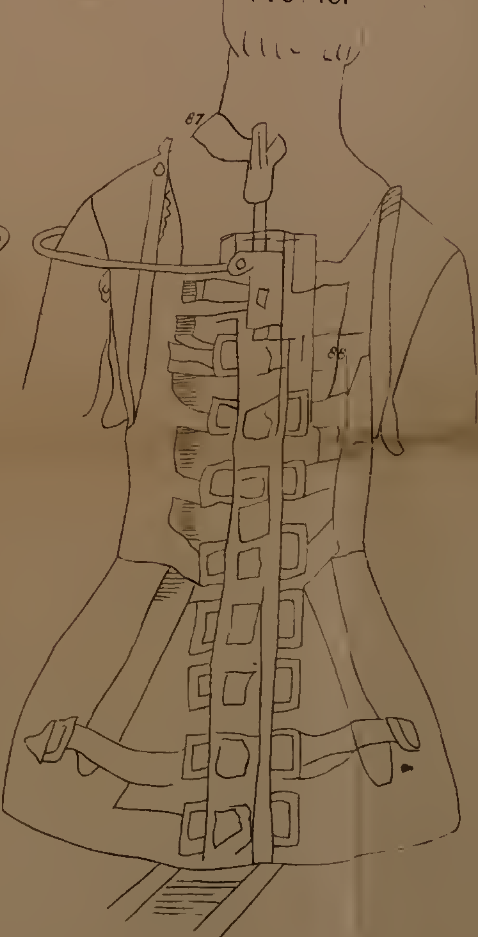
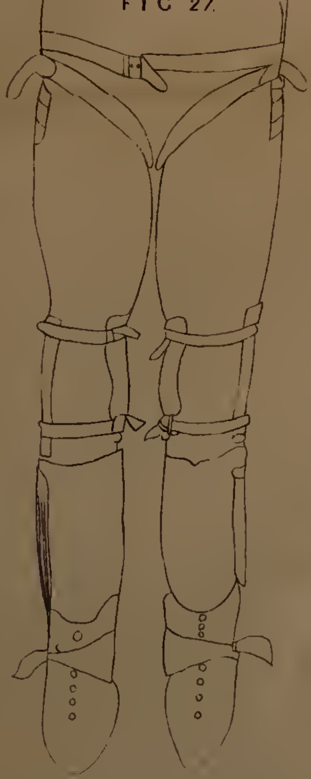


FIG 101



31

FIG 27



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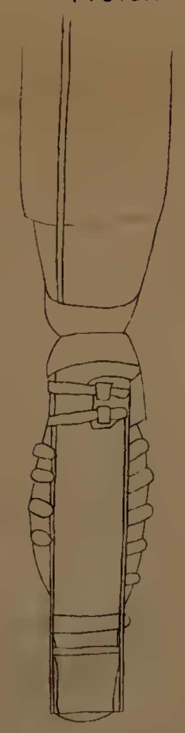
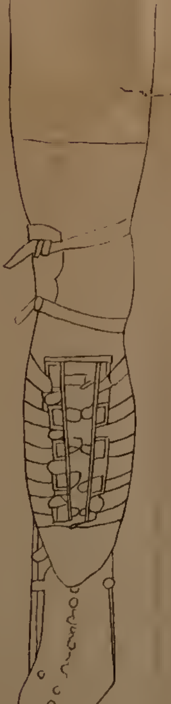


FIG 38



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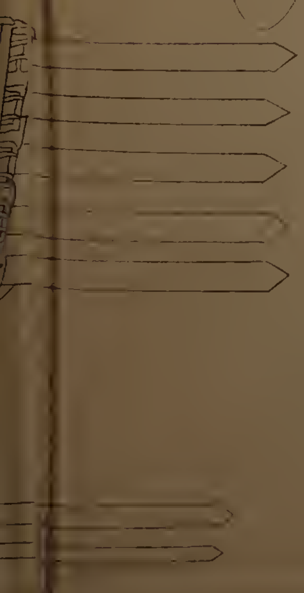

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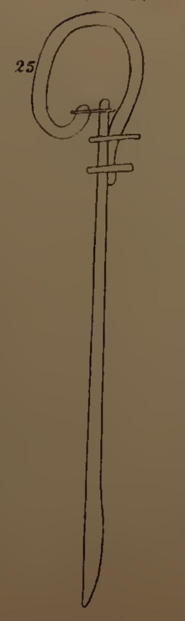


FIG 39

FIG 52.

FIG 51

FIG 53

FIG 41

FIG 40

FIG 102

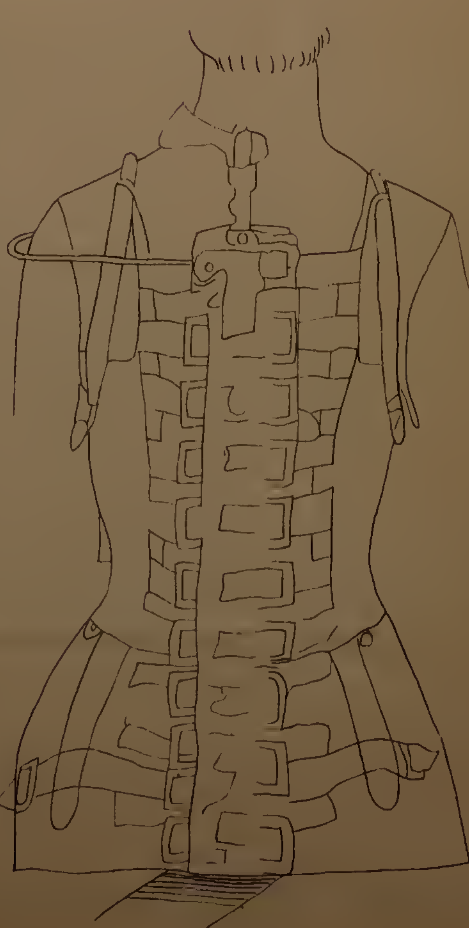


FIG 103

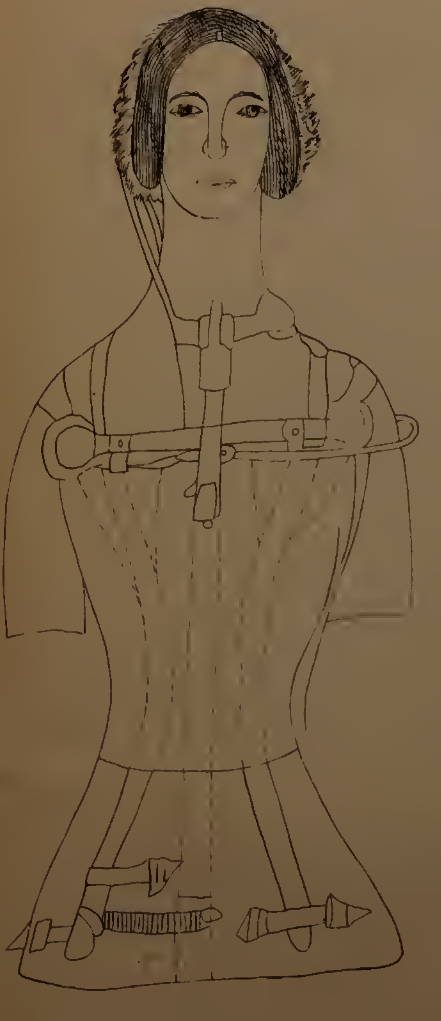


FIG 104

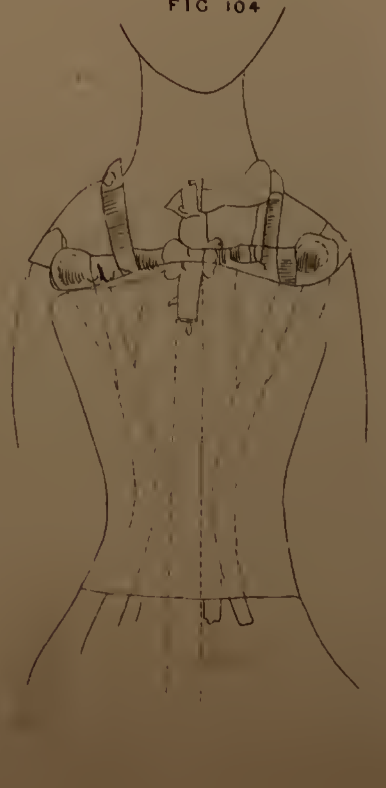
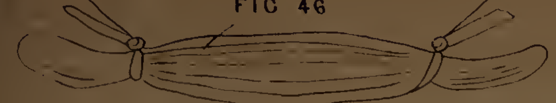


FIG 49

Drawn & Printed by Malby & Sons

Edward Eyre and William Spottiswoode,
most Excellent Majesty. 1857.

A.D. 1845. May 6. Nº10,659.
AMESBURY'S SPECIFICATION.

FIG 46


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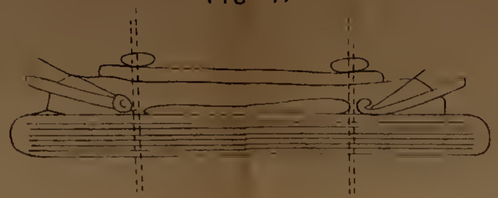

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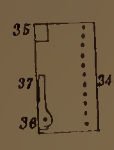

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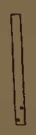
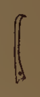


FIG 56

FIG 57.


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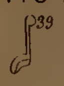

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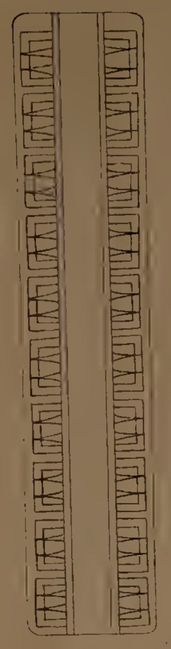


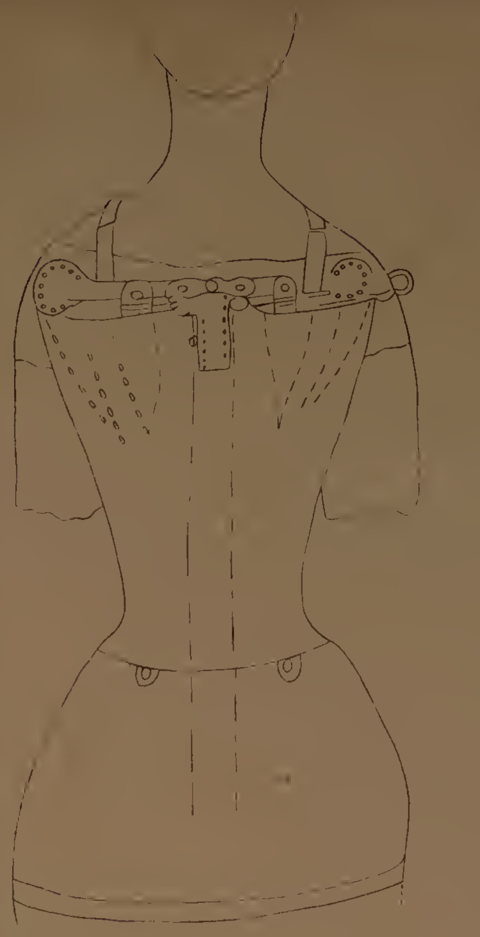
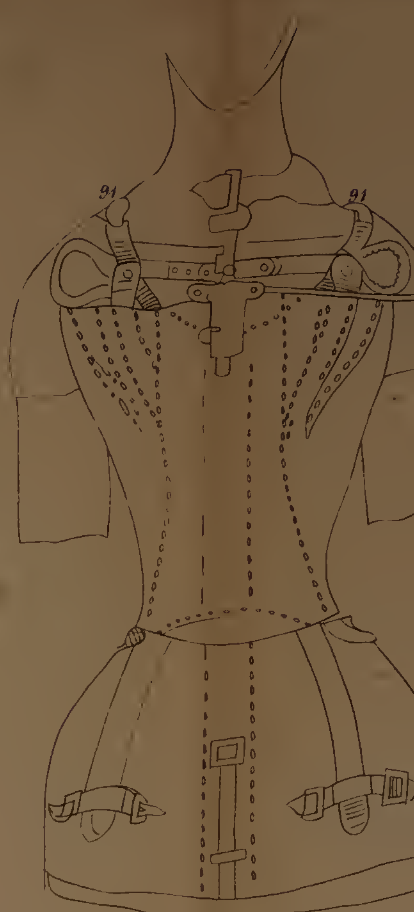
FIG 105


FIG 107


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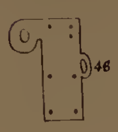

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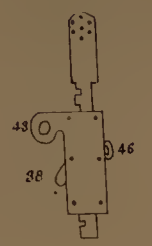

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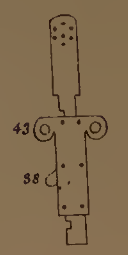

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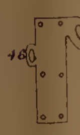

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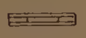

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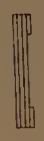
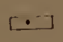


FIG 65

FIG 65.


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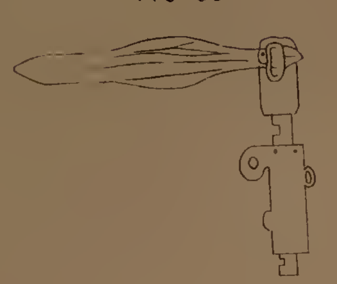

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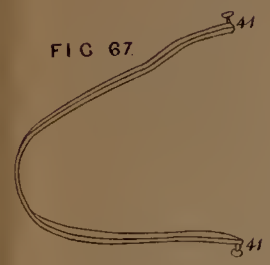

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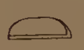

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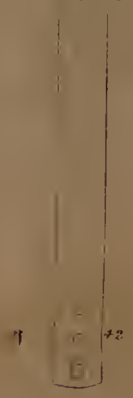

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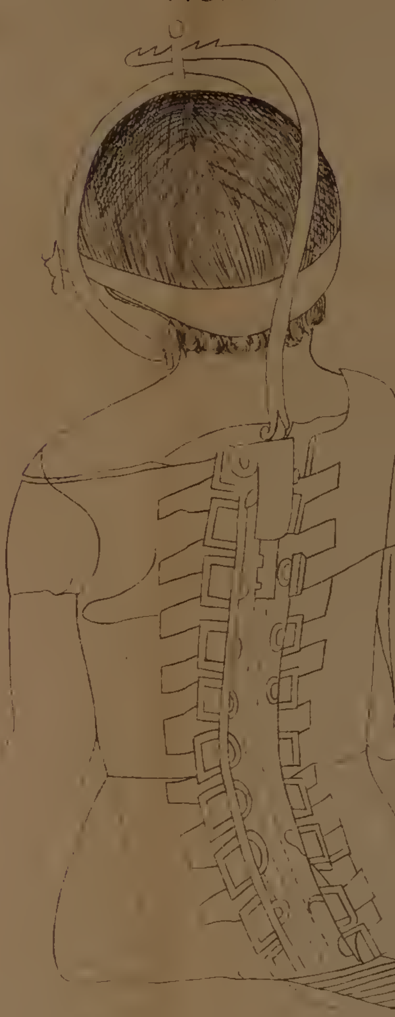

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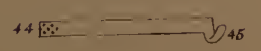

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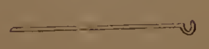

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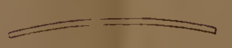

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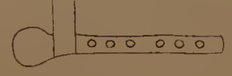
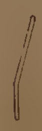


FIG 93


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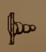

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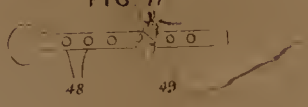

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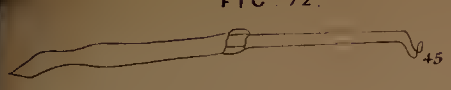

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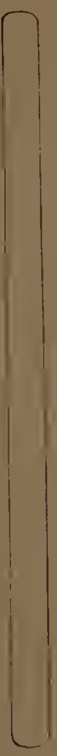

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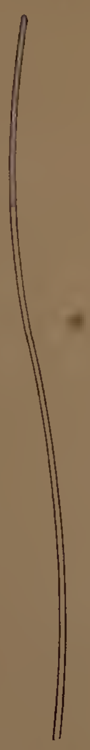

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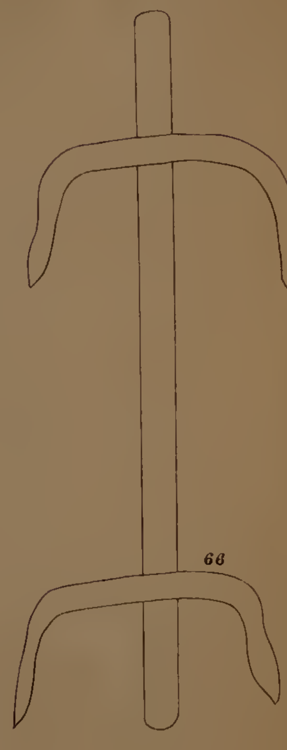

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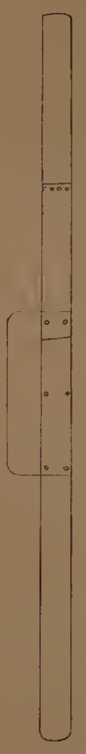

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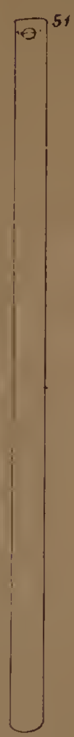

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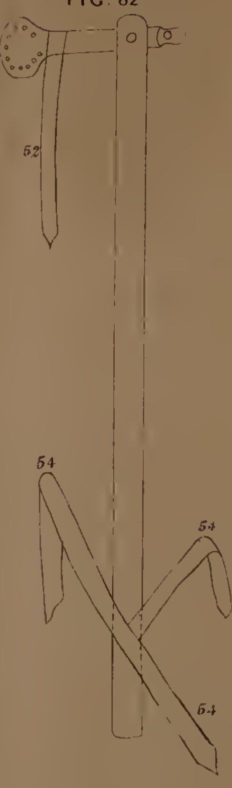

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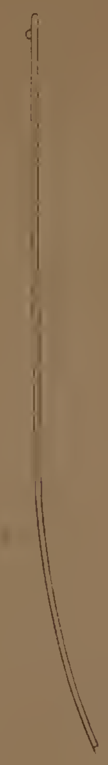

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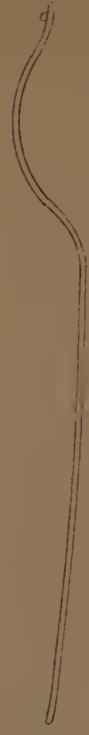

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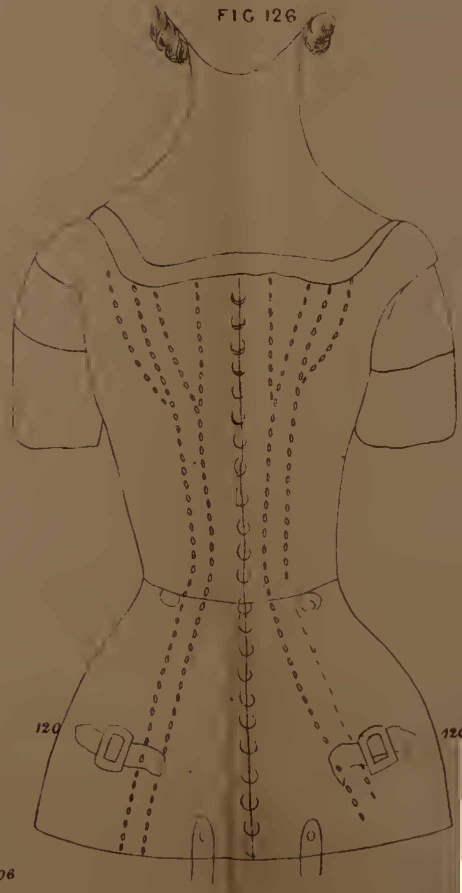

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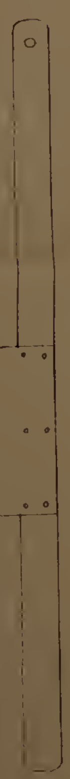

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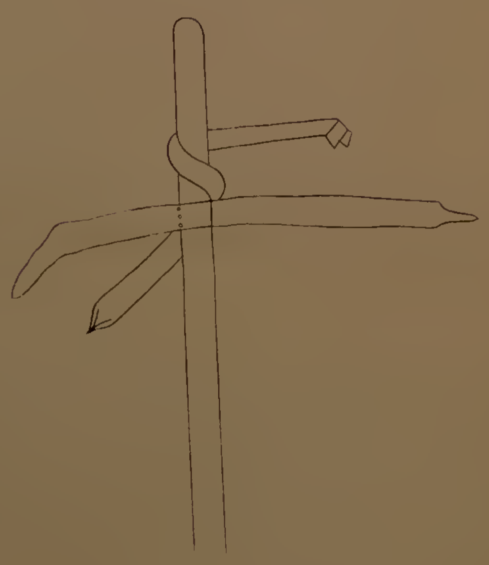

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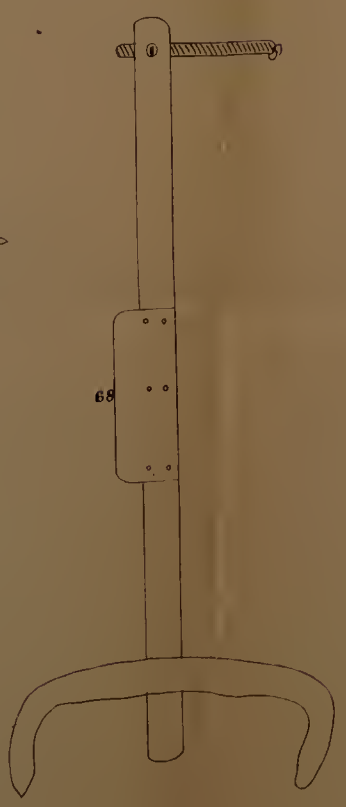

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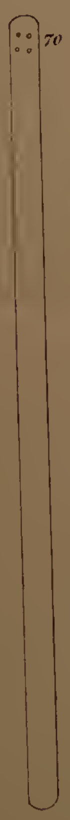

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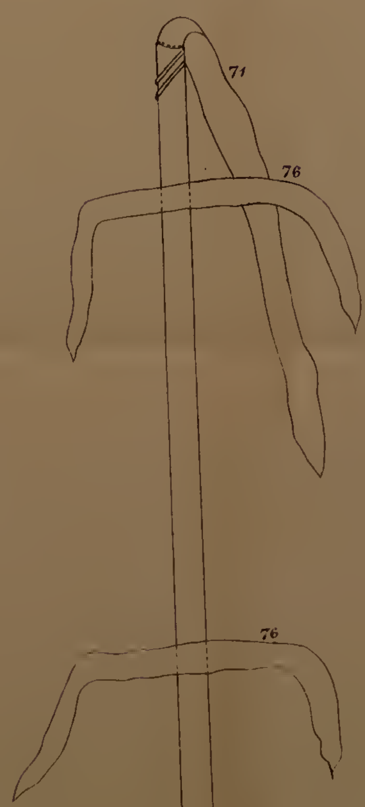

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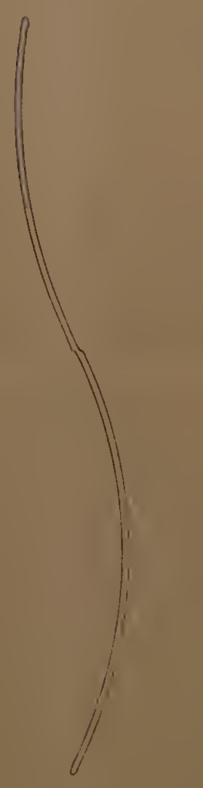

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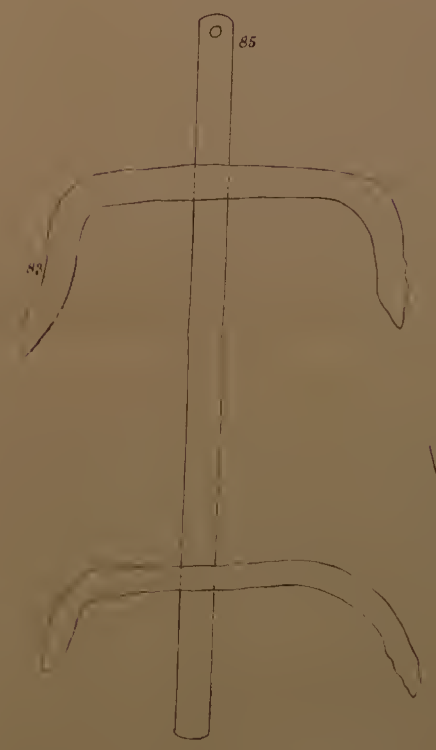

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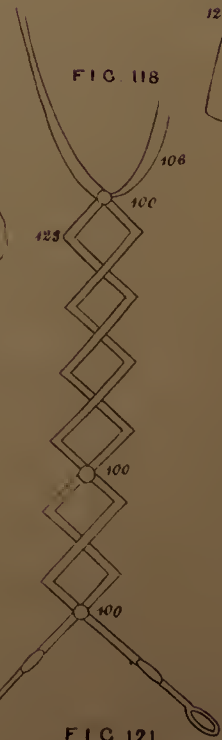

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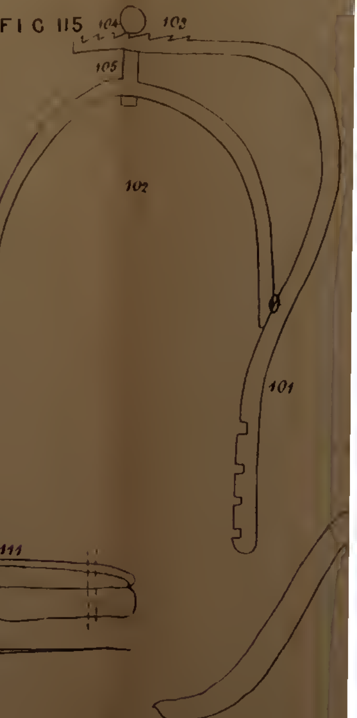


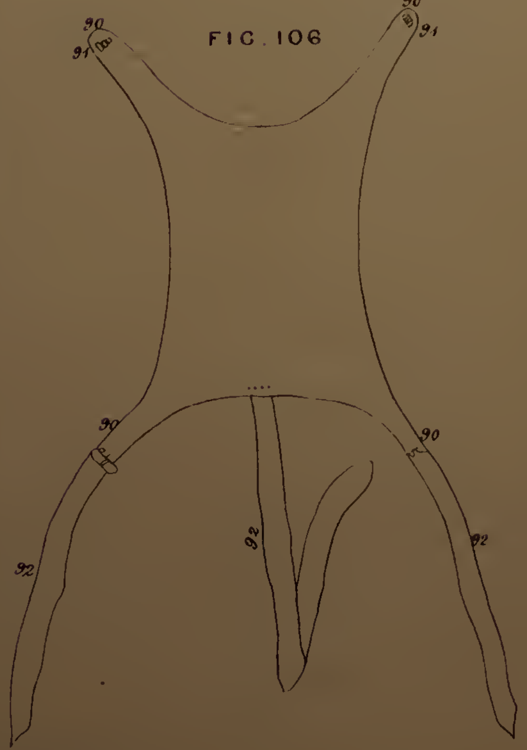
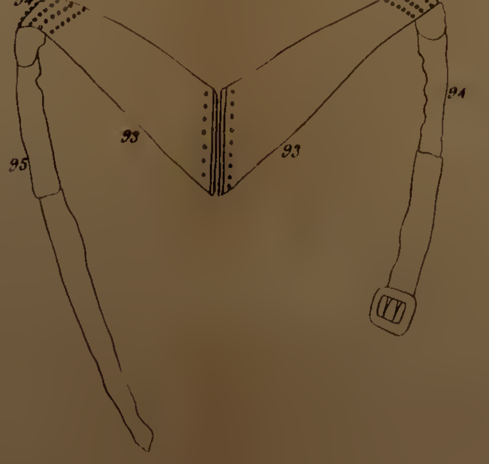
FIG 106


FIG 109


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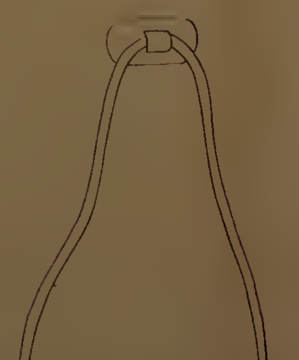

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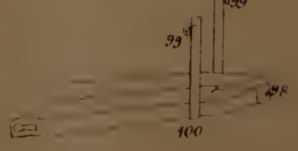

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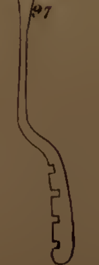

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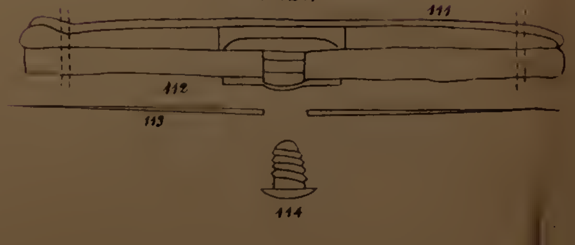

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London: Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1862.

2 SHEET.
N° 2

FIG. 107

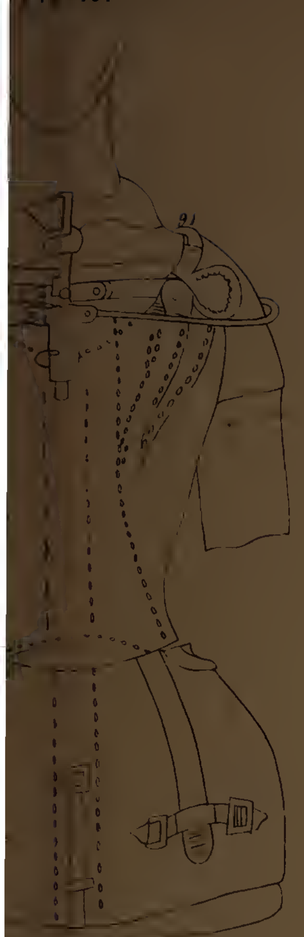


FIG. 108

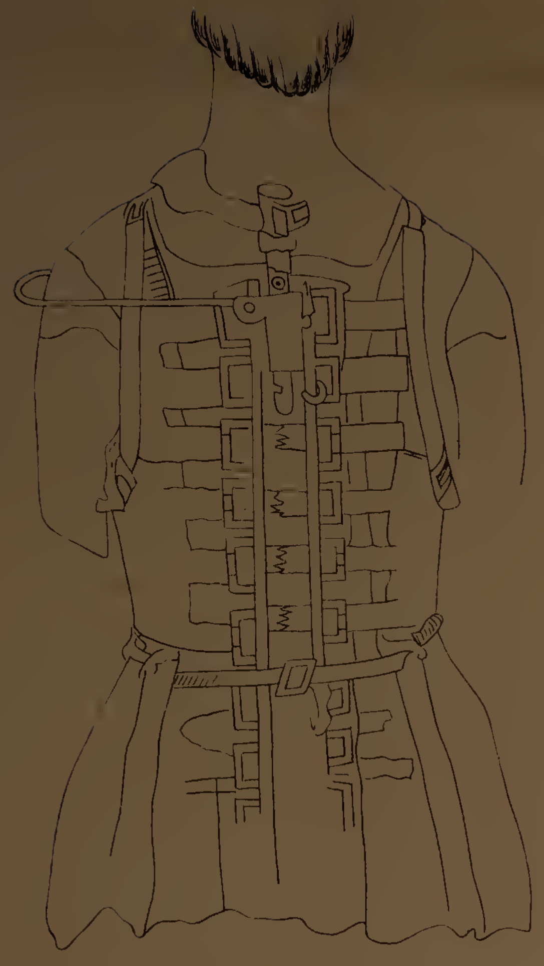


FIG. 110

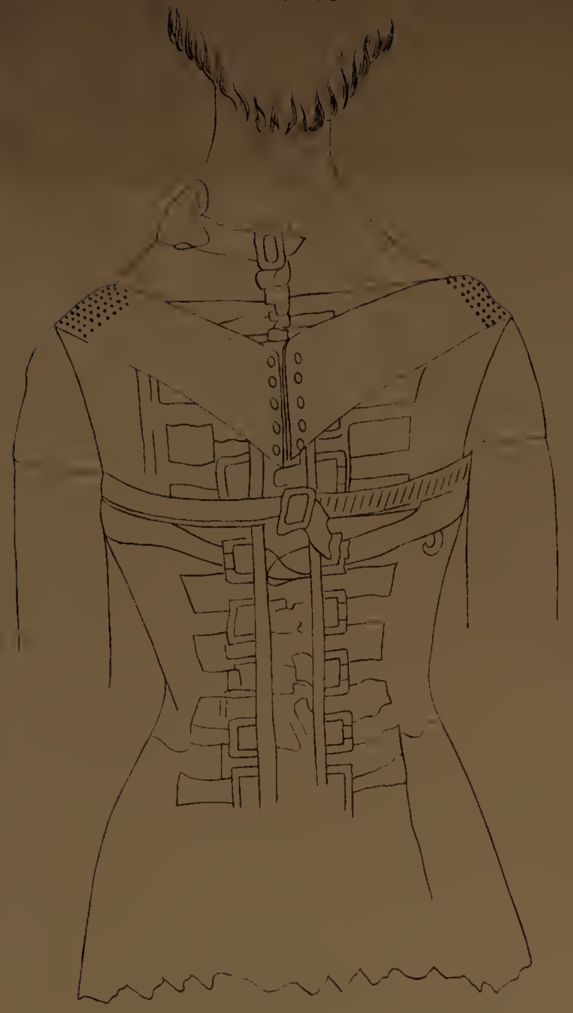


FIG. 112

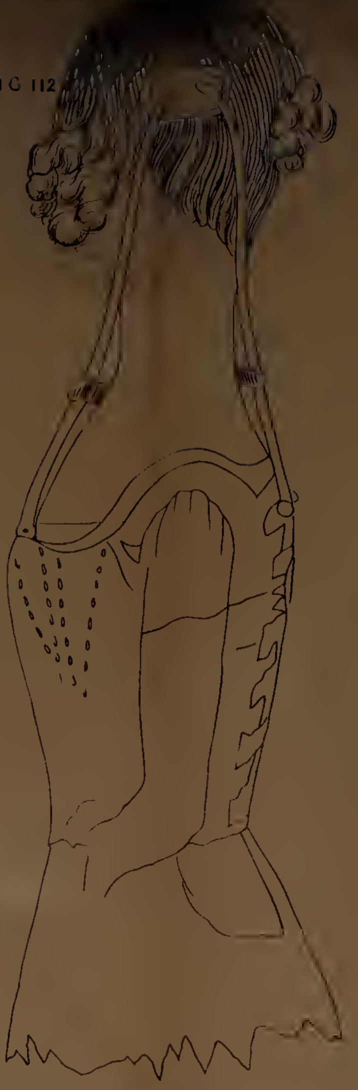


FIG. 116

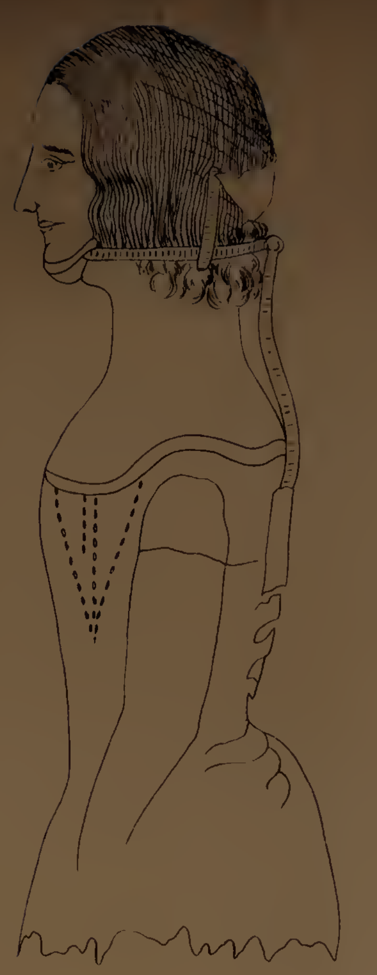


FIG. 131

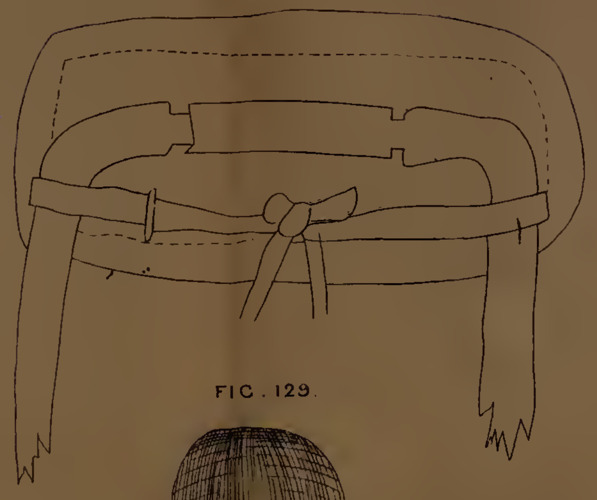


FIG. 132

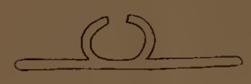


FIG. 117

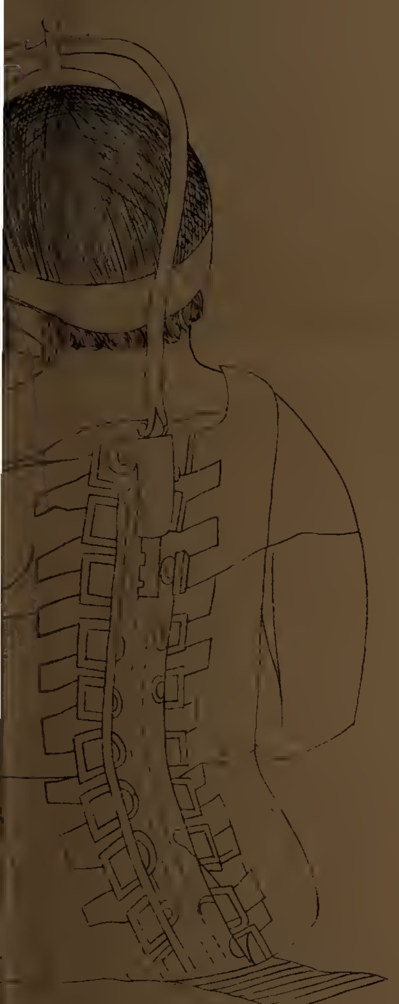


FIG. 130

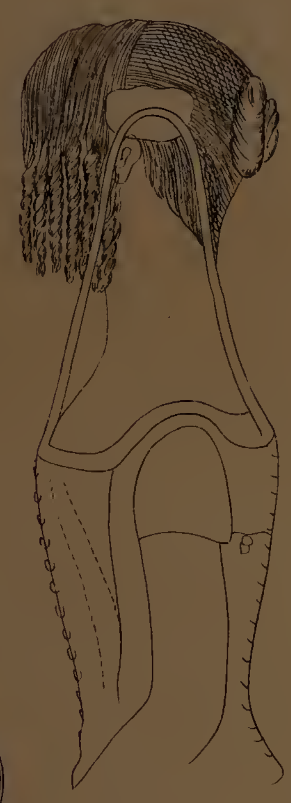


FIG. 127

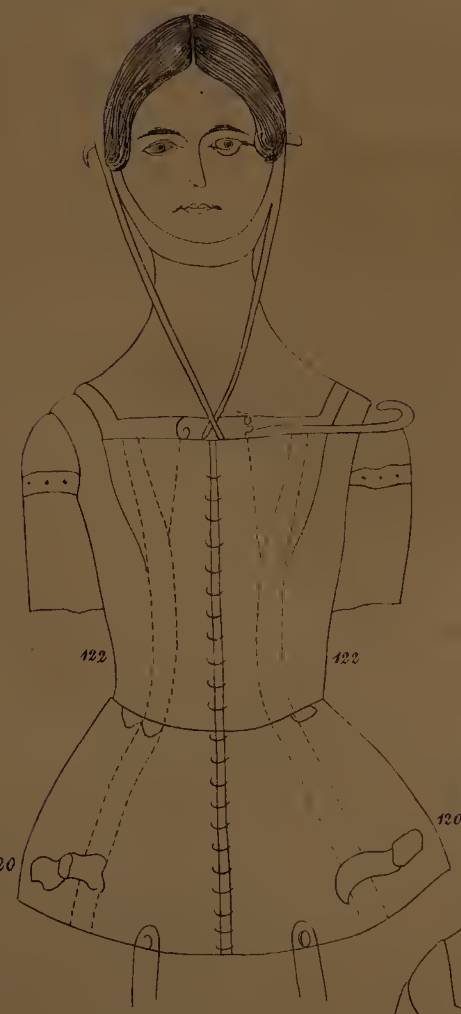


FIG. 129

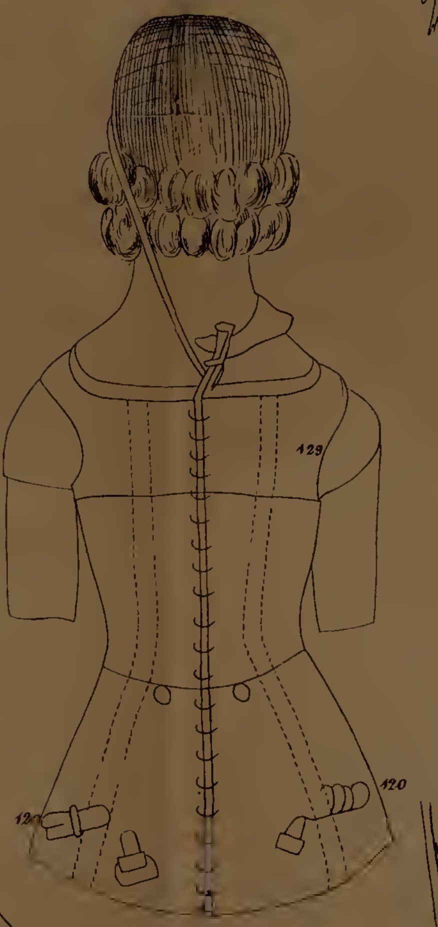


FIG. 133

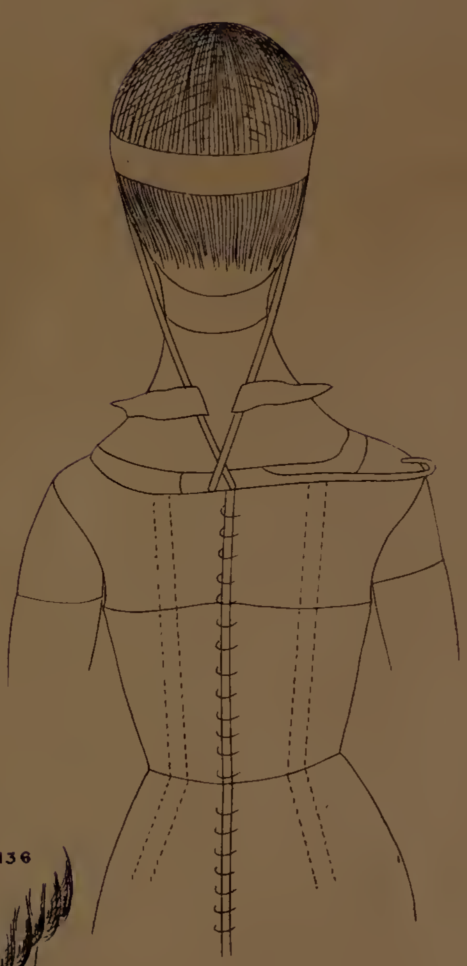


FIG. 128

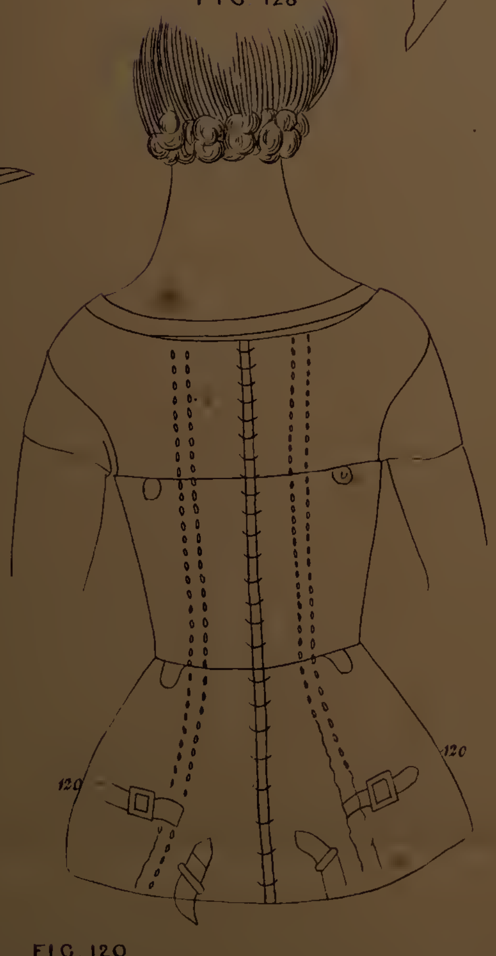


FIG. 134

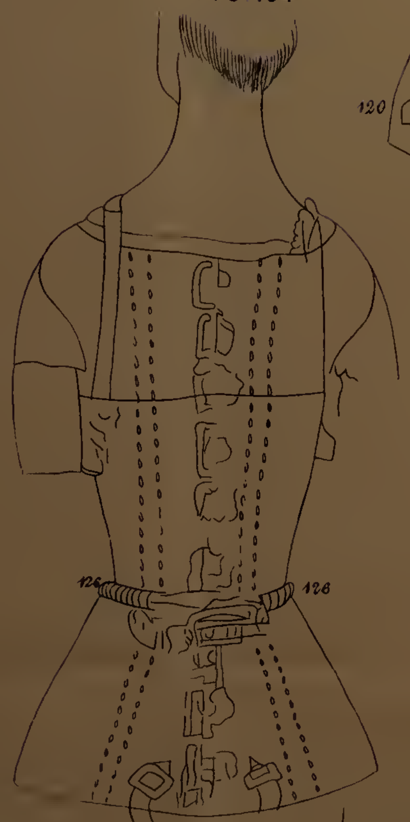


FIG. 135

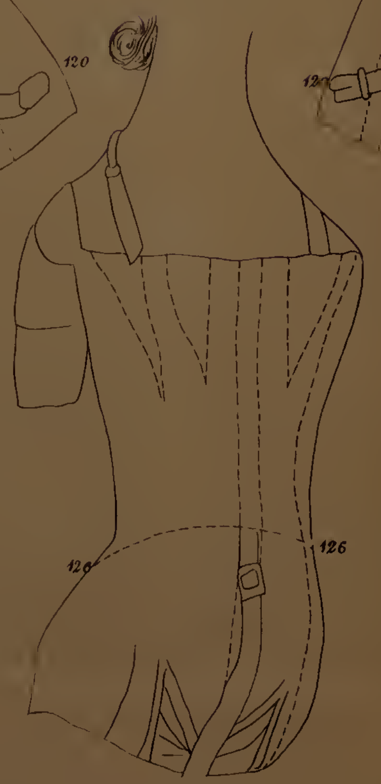


FIG. 136

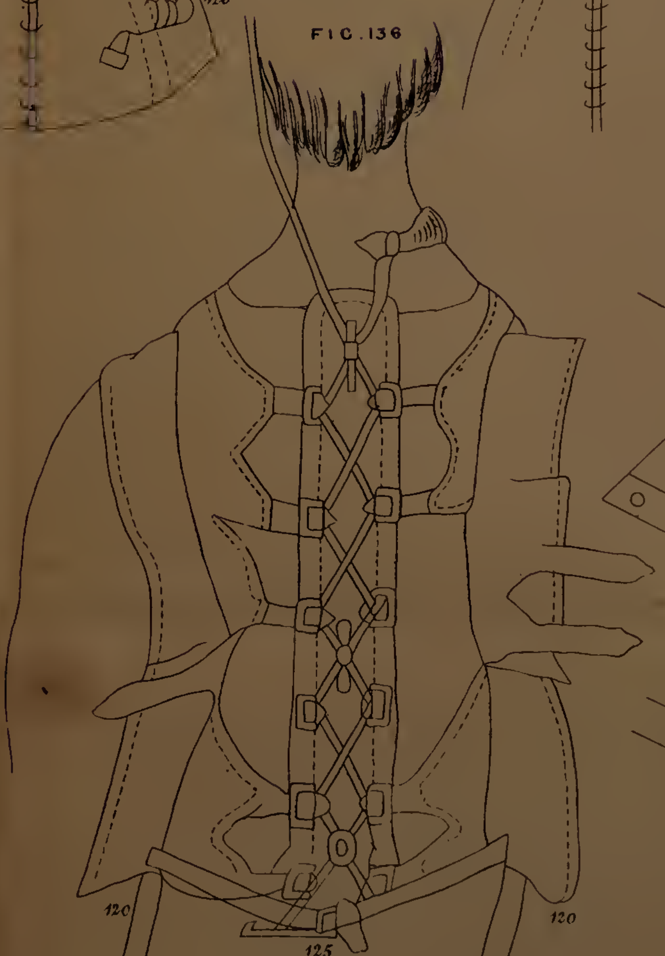


FIG. 123

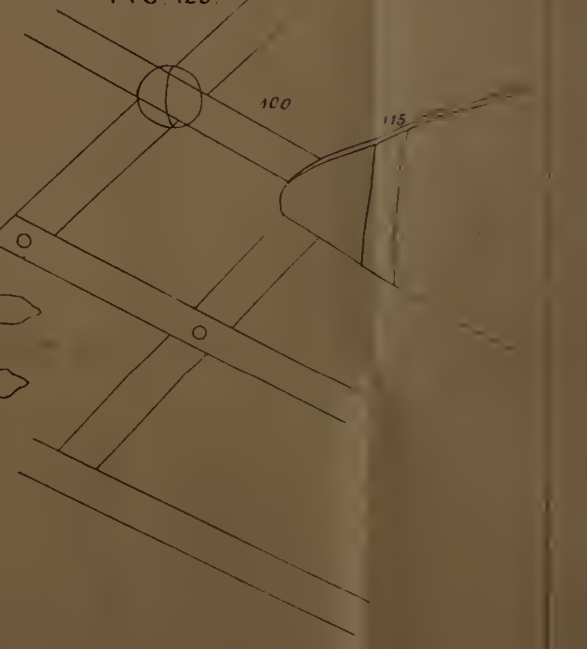


FIG. 126

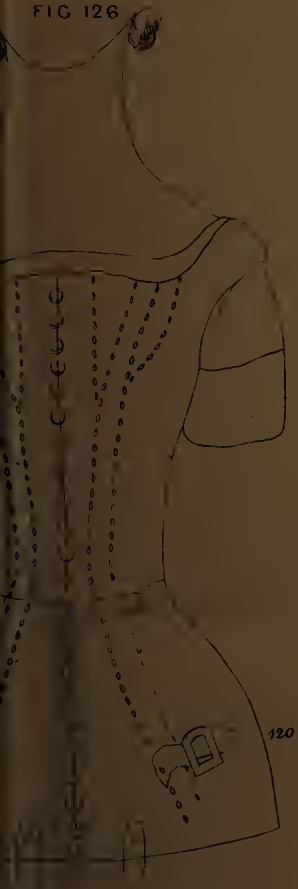


FIG. 120

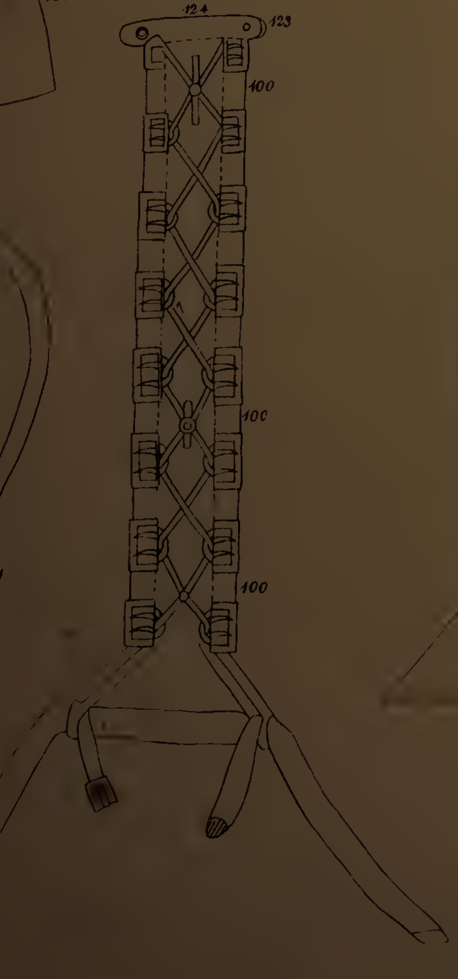


FIG. 119

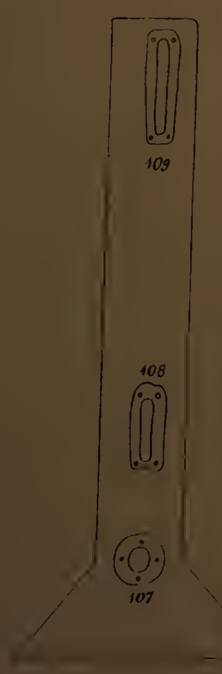


FIG. 124

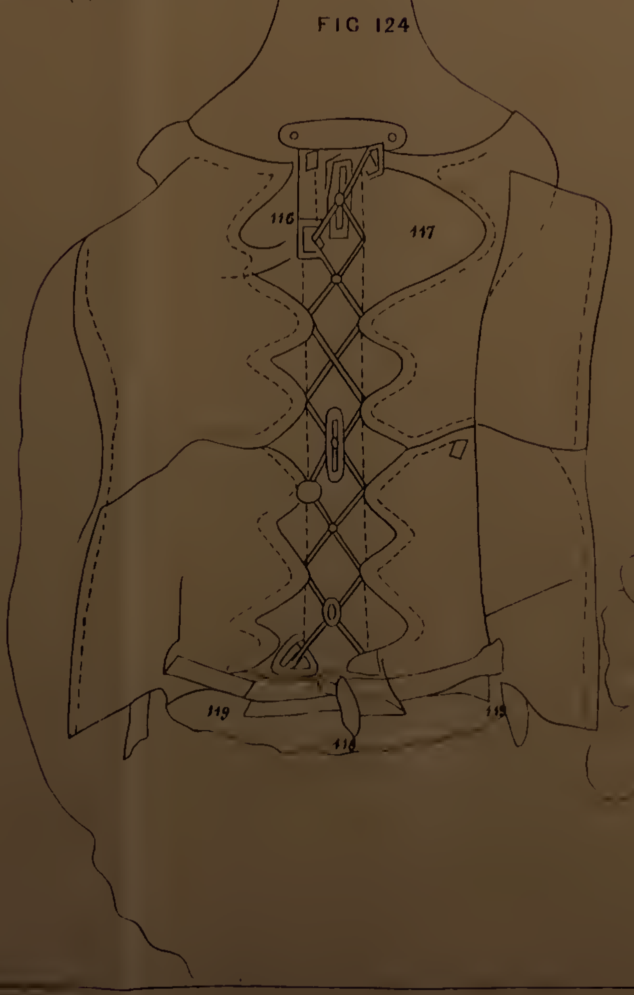


FIG. 137

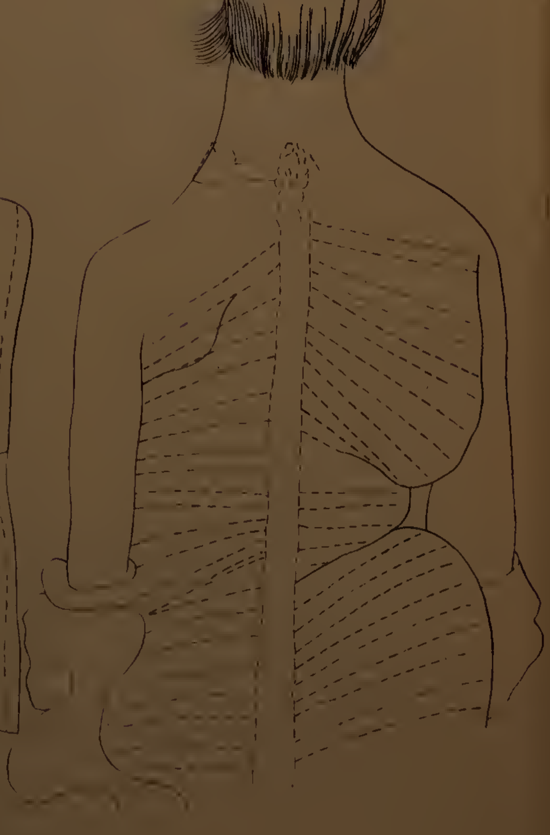
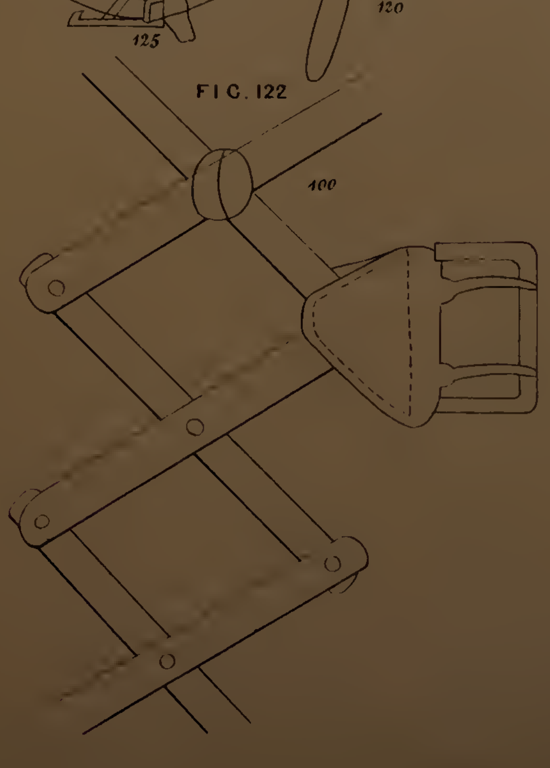


FIG. 122



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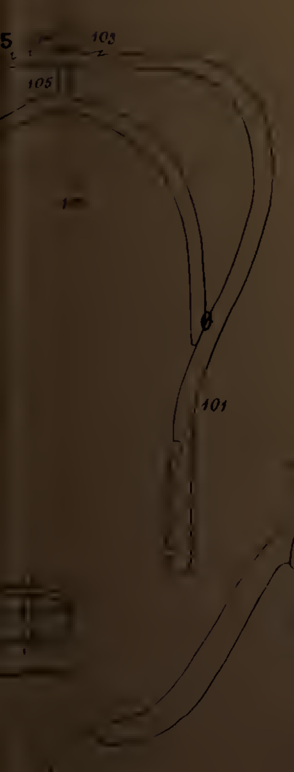

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